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A
SYSTEM
OF
DISSECTIONS,

Explaining the

Anatomy of the Human Body,

With the Manner

OF DISPLAYING THE PARTS,

The distinguishing

THE NATURAL FROM THE DISEASED APPEARANCES,

And pointing out to the Student the Objects
most worthy of Attention:

DURING A COURSE OF DISSECTIONS.

VOLUME I.

BY

CHARLES BELL.

THE THIRD EDITION.

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PREFACE.

In the study of every science, it is necessary to present to young men such general views of the subject as may give them a lively interest in the pursuit; direct their inquiries to the points of real importance; and confirm in them manly and steady resolutions to persevere in learning the details and minutiæ. These details, though in themselves disagreeable and tedious, are absolutely necessary; and no one who aims at useful knowledge, will acquiesce in general views, without endeavouring to follow up and complete the investigation, by studying the details from which they ought to follow, as legitimate conclusions.

In no department of science is attention to these two parts of study more indisas the want of arrangements and plans on which to proceed. How often is it found that young men who have begun their anatomical labours with a sincere conviction of the importance of the study, and with the most determined resolution to combat all difficulties, have, for want of plan, gone to work in a manner so disorderly, that they have been soon bewildered, and forced to renounce in despair a pursuit which, with their views better directed, would have been easy and certainly most valuable to them.

The object of this work is to assist the student in acquiring a knowledge of practical anatomy; in gaining a local memory of the parts; in learning to plan them on the dead subject; and in representing them to his own mind upon the living body. In accomplishing this design it has been my object to present an arrangement adapted to the purposes of dissection; to give a short but a precise and accurate detail of the anatomy; to show how the parts are to be laid open, and how they are to be distinguished in dissection or avoided in operation; to explain the consequences of each part to the great functions of the body, and to mark the diseases to which it is liable; and the appearances which characterise that disease.

It has been my principal object to direct the thoughts of the dissector to matters of practice, being well convinced that the questions of practice are for the most part best discussed when the dissected body is before him.

For the execution of a plan of so much importance, much allowance must be made, for the subject is extensive and difficult, and the illustrations are to be drawn from the whole range of the science.

A small volume has been lately published on the plan of this system of dissections, and the author has endeavoured to incorporate in it much of what is peculiar in this work. The sale of that volume has proved that the *folio* size is at least very inconvenient. It has therefore been thought right to print this edition in a portable form.

With many alterations and amendments the author offers this third edition to the student of anatomy, hoping that, if the cheaper and more portable form of the book may at first attract attention, he will in the perusal discover that there is something more in the science than can be taught by books, or than can be contained at least in a pocket volume; and that he will find his first studies facilitated, and the importance of a further prosecution of the science enforced.

London,
11, *Leicester Street, Leicester Square,*
October, 1809.

MR. BELL'S CLASSES.

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A Course of Operations on the Dead Body, superintended by Mr. BELL, Five Guineas. No Fee is required, if the Gentleman attends the public Lectures and Dissecting-Rooms.

All Correspondence respecting Gentlemen who wish to become House Pupils, must be through their Parents, Guardians, or late Masters.

INTRODUCTION.

DISSECTION consists not merely in the management of the knife; it implies also a knowledge of the methods of injecting and preparing the parts, of investigating the structure of the viscera, and of presenting them for demonstration. For this reason I shall enumerate here the chief circumstances to be attended to as introductory to a common course of dissection, that they may be concentrated, and the anatomy freed from needless repetition. Practical anatomy, like all arts in which an aptness and dexterity of the hand is necessary, is to be acquired not hastily, nor by precept; but an ease and certainty in its operations can be attained only after much labour. All therefore which is necessary at present, may be said in a few words; and I shall, in the first place, give some advice on the management of injections, and the means employed for facilitating the dissection and demonstration of minute parts, and then point out the course of study to be pursued in the dissecting room.

OF INJECTING.—Injections have led to many useful discoveries in anatomy; but it is to be regretted, that experiments in the dead body have been too implicitly trusted to, in accounting for the functions of living bodies. Physiologists seem, indeed, to have become bolder in the extravagance of their theories.

relying on supposed proofs by injection. Yet in spite of every disadvantage, the art of injection has contributed to the rapid advancement of our surgical knowledge.

IN THE CHOICE OF THE SUBJECT, the bodies of young persons are to be preferred, as much fitter for the injection of the arteries, and for minute injection : for while their blood-vessels have an elasticity and strength which enables them to bear the push of the injection by a kind of elastic resistance they give warning of the danger of rupturing the coats. In injecting the bodies of old persons, the piston of the syringe goes at first easily down, then stops, and if forced, most probably bursts the vessels, driving the injection amongst the muscles, and confounding the dissection. When any of the trunks burst in this way, the tension being taken off, their coats contract upon the warm injection, and they remain half filled.

In old age, this want of elasticity becomes very remarkable. There is often a kind of stiffness and rigidity, as if the coats of the vessels were corrugated ; a degree of that state in which we find the arteries when ossified, or when concretions are formed in their coats.

If only some coarse injection is to be thrown into the great vessels to shew their course, it does not much signify how it is done, or what injection is used, or what means are employed to facilitate the passage of the injection. But if the vessels are to be injected minutely, it is necessary previously to heat the subject well, by laying it in warm water, or applying steam to the surface. This is of more consequence than even the choice of the subject ; for, as the injection is intended to be fluid when warm, so as to pervade easily the minute vessels, and upon becoming cold to congeal and remain solid, it is necessary that the vessels be heated to prevent the sudden chilling of the injection : besides this heating of the body softens and relaxes all the mass of flesh, and brings it to a more suitable state for admitting injection. But it ought to be remembered, that, if the parts be overheated, especially where the vessels to be injected lie exposed, there is danger of corrugaing the coats of the vessels, and making them quite friable and tender. The common practice in the injection of the great vessels, is, to take first equal parts of brown and white spirit varnish, coloured with the same paint that is used for the coarse or wax injection; and this fine varnish injection, being moderately heated, and thrown in before the wax injection, clears its way, and moderately heats the vessels, so that they do not readily cool or retard the wax injection which is to follow. Even when using minute injection (which is size, coloured with vermilion) for the puspose of demonstrating the minute vessels, although the hard injection is thrown into the vessels after it, simply to stop the regurgitation of the warm and liquid size, and to retain it in the minute extremities of the vessels, yet it happens that the wax injection runs very minutely in this way. Size injection is the least expensive, runs more minutely, gives always a chance for beautiful specimens of minute injection, and can be pushed to any quantity, even till the skin of the limb becomes quite tense, without rupturing the vessels, or those vessels at least by which the coarse injection can escape. By this means, the vessels are dilated, the limb made warm and moist, and the wax injection flows easily into the arteries, whilst the size escapes with the slightest pressure into the cellular texture.

Care ought to be taken to exclude air and water from the arteries previously to the injection, lest they should retard it, or break the continuity of the wax in the arteries when cold: but often, upon an emergency, equally good injections of the arteries may be made by throwing in abundance of warm water before the wax. This, however, is not a practice to be followed; only it shews that it is rather the mixture of water or air along with the injection in the syringe, which is to be avoided; for, in that case, they will certainly be mixed in the vessels, and, upon cooling, the wax will be found broken and interrupted.

As to the veins, on the contrary, if there be any air or water in them previously to throwing in the injection (at least in the extremities, where, on account of the valves, it is necessary to inject from the branches towards the trunks), the injection is then confined to the great vessels; and the air or water, not being allowed to escape by exudation, must remain interrupting the wax. The most effectual way of avoiding the mixture of air with the injection in the syringe, is, after having drawn it full, to hold up its point. This allows the air to rise to the top; and before introducing the nozzle of the syringe into the pipe, the piston should be pushed gently, till the injection appears at it.

Of the Injection of Veins.—The success of the injection of veins depends entirely upon their being well washed with warm water, and repeatedly dilated, as they are for the most part foul with coagulated blood, especially in old people; although, in other respects, the veins of old subjects are in the best state for injection, being enlarged and varicose. The coagula must frequently be drawn out of the mouths of the larger veins before introducing the tube. If the veins of the thigh and leg, for instance, are to be injected, the tube should be fixed in a small vein upon the fore part of the foot, near to the great toe; and a stop-cock should also be fixed into the external iliac vein, within Poupart's ligament. Then the blood must be washed out by throwing in tepid water from the tube at the toe; first, with the stop-cock open: and afterwards when the veins are a litle cleared, the stop-cock at the top of the thigh is to be stopped, and the veins a little distended, and the limb immersed in warm water. Before injecting, the veins must be completely emptied by opening the stop-cock, and stroking up the thigh. The coarse injection should be thrown in while the limb is thus completely warm, and without any fine injection being thrown in before. During the injection, the stop-cock at the groin should be kept open, and some one placed to turn it when the injection appears at the mouth of the vein.—In this way, the air or water will be driven freely before the injection; and veins which would otherwise remain empty, will be filled; for by the dilatation, the valves lose their power, become too small for the diameter of the vessels, and allow the injection to go backwards into the branches.

In filling the arteries with coarse injection, when extravasation or rupture of the vessel happens, it seems strange that the rupture is commonly in the trunk, and not in the smaller branches, since we know that the strength of the larger vessels is owing to their greater elastic resistance, whilst that of the lesser arteries arises from their muscular power, which must cease in the dead body. But there is an obvious reason for this: the rupture of the arteries often happens from using the injection too hot; and as the great heat of the injection is in part corrected before it gains the extremities, they are not affected by it; while the root or trunk of the vessel being perpetually exposed to the hot stream, its coats are corrugated, and burst. Besides, as the injection, when it cools, plugs up the smaller branches, the force of a heavy and unwary hand is exerted upon the trunks, where the injection, being yet fluid, they are dilatable. Accordingly we find, that, in throwing in cool and fine injection, the rupture is always towards the extremities.

From all this it may easily be understood why at first the piston is to be pushed slowly and gradually whilst throwing in the fine injection; insinuating the fluid into the more delicate vessels, which are very easily ruptured; scarcely pressing at first, but allowing the piston to go down with its own weight, and gradually increasing the force. The coarse injection again is to be thrown in with a smart push. This is the great delicacy in injection; and to accomplish it without danger of rupturing the vessels, is to be learnt only by practice.

There are still other things which require attention; viz. the tying of all the vessels that may have been opened, and the fixing of the tube securely in the mouth of the vessel. When the injecting pipe is introduced into the vessel, it cannot be retained there by a simple knot, without a chance of its slipping off during the injection, or, if tied firmly, of cutting the coats of the vessel. Therefore after the ligature is drawn upon the artery including the tube, the ends of the ligature should be brought over the wings of the tube, and then carried round so as to include that part of the ligature which reaches from the mouth of the tube to the wing; and being tied there, the former knot is at the same time tightened, and the mouth of the artery drawn up upon the barrel of the tube.

THE COMPOSITION OF THE INJECTION.

Coarse Injections.—The coarse injection is composed of the following ingredients: for good common injection, tallow, one pound, resin, one pound, wax three ounces, venice turpentine, two ounces, spirit of turpentine, one ounce. Or bees-wax, sixteen ounces, resin, eight ounces, turpentine varnish, six ounces. The wax and resin give hardness and consistency: and the varnish is added to give it pliancy. A coarser composition may be made with tallow, wax, spirit of turpentine, and oil, coloured with the coarser paints; or, simply tallow and red lead, may be used when the parts are not to be preserved. These colours are generally used: vermilion, king's yellow, flake white, smalt, verditer, verdigrise, lamp black. They should be mixed with the turpentine varnish, and then added to the wax when melted; the injections should always be heated in an earthern pot set in boiling water, for water will not take a degree of heat to injure the colour, and, the chance of accident by fire, is, by this means much diminished. The injection should not be thrown into the vessels while too warm, for it will hurt their coats: the degree of heat should be such, that the finger can be allowed to remain in it for a little while.

For FINE INJECTION to be thrown in before the coarse, equal parts of white and brown spirit varnish is commonly used.

For MINUTE INJECTION, painters' size coloured and strained, serves every purpose; a finer size may be made of isinglass. An injection to be used cold, and which is well adapted for class demonstration, or where the dissection is intended merely to demonstrate the vessels, without preserving them, may be thus made;—take red lead and linseed oil, and mix them till they are of the consistence of putty, add a little turpentine varnish, then a little spirit of turpentine, lastly, just before injecting it, sprinkle a little water into the mixture and agitate it. This injection runs very minutely, and for preparations there may be added fine vermilion to heighten the colour.

PREPARATIONS OF BONES.—It has already been observed, that the limbs, or any part of the body, are easily dilated by the minute injection, in consequence of its escaping into the smaller vessels. This must in some measure be prevented when it is intended to display the minute vascularity of membranes and joints, and more especially the vascularity of bones; for while the injection freely escapes into the dilatable cellular membrane, it will never penetrate into the more resisting parts, as the bones and cartilages, therefore, when a minute injection of the bones and cartilages is intended, a bandage must be rolled from the toes to the upper part of the limb, not very tight, but so as to restrain the enlargment of the muscles and cellular membrane by the force of the injection. In this way, the minute vessels are filled, yet little extravasation allowed; for there is an equal resistance in the soft parts and in the bones, and the parts partake more equably of their natural proportion of the colouring fluid. By this precaution, the bones may be very successfully injected, so as to show the stages of ossification. And not in sound limbs only, but in cases of diseased bones, with open ulcerated surfaces, I have succeeded in the injection, by firmly bandaging the limbs; when, otherwise, the injection would readily have escaped, and important morbid preparations have remained useless.

The minute vascularity of a bone is to be shown, after injection, by a long maceration of it in diluted muriatic acid; which, by dissolving the earthy part of the bone, leaves the fibrous part (in the interstices of which the earth was deposited) flexible, and without any character of bone but the form. In this state, it is like cartilage, soft and yielding, but fibrous, and the vessels will not be more discernible than before. The bone is to be thoroughly dried, and then plunged into a glass of clear spirit of turpentine; when, as soon as the spirit penetrates the cells, the bone becomes quite transparent, and the vessels easily distinguishable, branching through its substance.—In corroding shells to show the glutinous basis in which their earthy part is laid, spirit of wine, with a little of the acid dropped into it, has been used, by which the delicate web is preserved, whilst the other parts are taken away. In the same manner, in the maceration of bones, when the maceration is expected to be tedious, it may be necessary to add spirit of wine to the menstruum to prevent the size in the vessels from being resolved and washed away.—The most beautiful preparation of bone is the simple section of the cartilage, or apophysis, in young subjects, where the injection has run minutely, and while the nucleus of bone is still small and red with injection. This nucleous is seen lying in the middle of the cartilage, with the vessels crowding from the surface towards the centre, and terminating in the bone; or perhaps only a small and delicate artery is seen pushing into the centre of the cartilage, and terminating in a point the beginning of a future bone. The cartilages in this state, when cut in thin slices, and suspended in spirits of wine, are beautiful; or when those slices are dried and suspended in spirits of turpentine, the cartilage becomes so transparent that it is with difficulty discerned in the fluid, and nothing is seen but the nucleus of bone, with the arteries beautifully ramifying to supply it: Or the nucleus of bone may be tinged by solutions of some of the metals in acid, while the cartilage will remain perfectly white. Such preparations may be infinitely varied, forming the most beautiful examples of the changes going on, not only in the bones, but, by analogy, in the whole body.

The marrow, also, may be displayed, after injection, by maceration in water; or by sliting up the cylindrical bones, and preserving them in spirit of wine. When such a section of a bone is dried, and put in oil of turpentine, the vessels supplying the marrow bags, being collapsed to the side of the bone, are seen in great profusion.

The structure of bone is demonstrated, independently of injection, by maceration and burning. By exposing bones gradually to a red heat, and so placed that they may be equally supported, the animal part is burnt away, while the earthy part remains behind, a calcareous phosphat, retaining the figure of the bone, but deprived of its gluten and fibrous part, which gave it strength. This is just the reverse of what takes place in the corrosion with the muriatic acid. In the one case, the animal fibre is burnt away, leaving the secreted bony part in its original figure; in the other, the calcareous or osseous part is dissolved in the acid, the softer parts (which, when endowed with living properties, were capable of secreting this earthy part from the blood) remaining undissolved. These preparations, therefore, should be contrasted.

If a bone is burnt, and then put in acid, it is entirely destroyed. If, therefore, after burning it completely, warm wax be poured into its cavity, and it then be corroded in acid, the cells will be elegantly cast in wax.

For example, to make a cast of the intricate passages of the temporal bone, with a view to demonstrate the cavities of the internal ear, we first enclose the temporal bone in Paris plaster, leaving open the meatus externus: then dry it thoroughly by the fire and heating it gradually, throw it into the fire. When the bone is calcined take it out and pour melted lead into the passage of the ear, lastly break off the Paris plaster, and put the bone into the muriatic acid, and you have a perfect cast of all the cavities of the ear.

Of Corrosions.—Corroded preparations are the most elegant of all, but require great care. They are generally made of the injections of the solid viscera; as the heart, lungs, liver, kidney, and spleen. Harder injection than common is required for these, and no minute injection need be thrown in before. If the injection succeed, the only other circumstance which requires care, is that we place the part while the injection is yet warm, as it is intended to remain, and where the corroding acid may be easily applied. When the fleshy part is dissolved, it is to be gently washed away by the agitation of the water; and it should not be attempted to be lifted out of the water till entirely freed from the parenchymatous matter, which, by its weight, might break the delicate branches. The menstrua are the muriatic and nitric acids; the latter of which M. Sue found a more perfect menstruum, and less apt to affect the colours of the injection or minute vessels.

Compositions of glass may also be used in making casts of many parts, as they admit of a great variety of transparent colours; the soft parts and the bones being burnt away, while the paste is acquiring its glassy surface.

Of Wet Preparations.—In preparing morbid parts, there are often appearances, curious and important, which cannot be preserved. Often in examining the parts, the colour is the only criterion by which the nature of the disease is to be determined; and this it is often impossible to preserve. Recourse must be had to painting, to give the lively tints which alone remain of the disease, &c. But even here injections may be of much service, as a means of making the parts more beautiful or natural, and more extensively useful, by preventing that confusion which is so often found in wet preparations having no distinctions of colour. Even in organic affections of the heart, lungs, intestines, &c. injection gives a splendour and consequence which the real importance of these parts would perhaps claim in vain; and in preparing such parts, great expertness may be acquired in giving them natural or beautiful tinges, by injecting the vessels with coloured fluids.

In preserving thick fleshy parts in spirits, it will be necessary to inject spirits into their vessels; which thoroughly pervading them, tend greatly to preserve them. Liquors for preserving preparations have been much boasted of since the time of Ruysch; but to clean and unadulterated spirit of wine there can be no objection. It must, however, be diluted according to the delicacy of the parts to be immersed in it. Sometimes when very delicate membranes are put up in pure spirits, they will be found next day shrivelled and shrunk up to the top of the jar: but by saturating the spirits with sugar, they lose this property, and the membrane hangs loosely in the jar. The glasses containing such membranous parts should be allowed to stand some time before being finally closed: for though the membrane, being full of water, when first put into the spirits, hangs elegantly enough; yet, when it has parted with its superabundance of water, and received the spirit, it will become so light, that it will swim upon the surface, and require little hooks of glass to be put to its lower parts to weigh it down.—Wet preparations often require to have the spirits changed upon them several times before they are finally put up, to prevent the possibility of their tinging the spirits after they are closed: Or, perhaps, it may be necessary that the parts should be stuffed, or held out in particular postures, till they be so hardened, that they may remain unsupported in the jar. For this purpose diluted muriatic acid and nitrous acid combined, is sometimes used; or the diluted nitrous acid simply; or a solution of alum and common salt. These give the parts firmness and strength to support themselves in the glass. Care must always be taken to macerate the parts well previously, and to free them entirely from blood.

When delicate membranes are to be injected either with quicksilver or with fine size, instead of tying all the vessels by which the fluid may escape, I have found it necessary only to sear the edges of the membrane with a heated iron; or, after having fixed the tubes, the common method is to dry the edges all round, while the middle part is kept soft and moist. When it is required to demonstrate the vascularity of a part where there is no opportunity of injecting it, if membranous, the blood may be detained in the vessels by quickly drying and varnishing it. The blood, when extravasated, or when (as in the piles) preternaturally collected in vessels, may be coagulated by a solution of alum; or blood inflamed parts may be coagulated by distilled vinegar. In other instances, as in preparations of the lacteals, their natural fluids may be coagulated and preserevd by plunging them suddenly into strong spirits.

To demonstrate the rete vasculosum of the *retina*, a drop or two of solution of caustic alkali, may be put into the spirits, by which the matter of the nerve is dissolved or made transparent, when the vessels of the nerve make the most beautiful exhibition.

DEMONSTRATION OF MINUTE PARTS.—There are many parts of the body which it is impossible to keep for any time in their original beauty, and these the most delicate and interesting; as the organs of the senses, and all minute nervous parts, the villi of the intestines, the comparative anatomy of insects, the incumbated egg, &c. The ready demonstration of such delicate parts in the fresh subject is the truest test of the abilities of the practical anatomist; for there is more delicacy and nicety required in exposing these parts, and more real benefit to be derived from it, than in making the more lasting preparations.—The minute structure of many of these parts must be dissected and unravelled under water, where the loose and floating membranes display themselves; while, out of the water, they would lie collapsed and undistinguished. In such investigations, I have found nothing of so much service as jelly made strong and quite transparent. When a delicate part is completely dissected (suppose it to be the coats of the eye,) place it in the jelly as it is becoming firm, and hold out the parts; and they will be retained, elegantly displayed, either for demonstration or for drawing.

In some instances, (as in dissecting the eye and ear,) freezing mixtures have been employed, which allow the frozen parts to be dissected without the fluids escaping. It is not always with the knife that we must expect to dissect and separate the minute and transparent organs, but frequently the object is best attained by blowing betwixt the lamina: as of the pia mater, the capsule of the lens, the cellular coat of the intestines, &c.

In anatomising insects, two small and very delicate hooks are used, by which the parts are to be torn asunder; the attempt to dissect them with the knife will be quite vain. It is by this means that Mr. Macartny has succeeded so well in his preparations of comparative anatomy.

Boiling and maceration are often employed to demonstrate the muscularity of parts; as the course of the fibres in the heart. The course of the fibres in bladder may also be shown, by distending it, and plunging it suddenly into boiling water. In this way, also, the coats of arteries, the rete mucosum of the skin, &c. may be demonstrated. Immersing the skin in boiling water before injection, is said to make the villi stand out more from the surface. Although immersing in boiling water will not separate membranes into their layers, sometimes alternately macerating them in cold and warm water will do it, or macerating till putrefaction takes place, and then plunging the part into boiling water, as is done to separate the cornea.

Boiling gently with a solution of nitre and alum is used to render evident the muscularity of membranous parts. The solution makes the muscular fibre of a red colour: but, perhaps, minutely injecting the parts is a more natural and effectual method; for, after a successful injection, the muscular fibres of the bladder, for instance, being very vascular, become distinguishable.—Nervous membranes, as the expanded nerve of the eye and ear, the septa of the vitrous humour, and the membranes of the egg, become opake when vinegar is poured upon them. Without this, the latter cannot be distinguished.

To prepare for the demonstration of the brain, I have been in the use of injecting it minutely with fine size, which even if it happen to be soft, will give firmness, and enable one to display the parts better.

The brain and nerves, by being exposed to the oxygenated muriatic acid, are made firm, immersed in a solution of corrosive sublimate and spirits, the brain is hardened and can be preserved. But to preserve preparations of the brain, spirit of wine, corrosive sublimate, and nitric acid combined, make the best liquor.

OF THE LYMPHATICS.—The injection of the lymphatic vessels is the most difficult part of practical anatomy. The subject taken for lymphatics, should be under twenty-five years of age, and dropsical.—The apparatus in the shops is fit for every purpose; generally however, the tube of glass is too thick, which makes it heavy and unwieldy when filled with mercury. A provision of very fine forceps, scissars, lancets, needles, and thread, should be at hand, and the assistant must be equally adroit with the anatomist.—The mercury must be pure, and the globules leave no tract behind them.

Supposing that an extremity is to be injected: the veins and arteries should be previously injected. It is placed with the upper part of the limb a little inclined downward. The integuments are to be dissected off; the common cellular membrane left; lines will be perceived small as the most delicate nerves, but without their white opacity, and taking a course somewhat obliquely, crossing the cutaneous veins, below the ancle and on the wrist. It will be difficult to introduce the point of the smallest tube, unless we proceed in this way. Having discovered a lymphatic, a delicate needle and thread is put round under it: then with very fine scissars cut the filament half through. The scissars I use in preference to the lancet, as by snipping the lymphatic a little obliquely, an opening is made which is more easily found than a puncture. We may now inflate the vessels by the small blow pipe, making the stream of air play on the punctured part of the vessel: but I never do this. I introduce into the vessel, the delicate steel poker, if it enters smoothly and without resistance, I know that it has found the vessel; if it is pushed on with difficulty, that it is making its way amongst the common cellular substance. When the poker is introduced, I then take the pipe with a high column of mercury and make the stream play along the poker, when the mercury never fails to enter the lymphatic; and now the point of the tube easily enters the distended vessel, when the poker is to be withdrawn.

The mercury should be allowed to flow freely: from one small vessel, on the wrist or foot, six or ten lymphatics may be filled on the thigh or arm. With similar precautions other vessels are to be sought and filled.

If we have to inject lymphatics betwixt the glands and trunk of the system, the pipe may be plunged into the glands so as to fill its cells, from which it will pass or may be pressed into the second set of vessels.

The lymphatics of any subject may be injected. We have them here injected and dissected for the lectures on that subject, in whatever body may offer in the rooms at that time, but when there is much fat the dissection of them is difficult, and to preserve them it is absolutely necessary that the subject shall be thin, and anasareous.

When a limb is injected, it should be laid horizontally: we begin the dissection on the lower part, when we have dissected the vessel to some extent, a very fine thread is tied round it and this ligature is repeated as we proceed up the limb, at the distance of five or six inches. When a vessel of perhaps three feet in length, is left without this interruption to the mercury, it cannot be expected that when the vessels dry, and the valves consequently shrink, the coats of the vessels will bear so high a column. It will always be remembered that it is the heighth of the column, not the quantity of mercury in the tube, or in the vessels, which governs the force with which it presses at the lower part.

At all times, but especially when the coats of the vessels have dried it is necessary to keep the preparation in a uniform temperature. If the heat be increased the vessels will burst; if they are prepared in a warm temperature and removed into a colder place they will shrink.

I strongly recommend to the student the perusal of Sheldon's introduction on the preparation of the Lymphatic Vessels.

OF A COURSE OF DISSECTIONS.

I advise the student to make himself perfectly master of the Bones, before he take part of a muscular subject. When he takes the knife first in hand, his object ought to be, to learn to use it with ease and freedom; to acquire a mobility of the wrist and fingers.

The assistant will first put him on a fleshy part, teach him to lay the edge of the knife to the individual fibres, and cut always in the course of the fibre. When he can make a clean dissection of the gluteous muscle lifting the integuments at once, leaving the fibres distinct and clear of cellular membrane, the next step is to know the nature of cellular expansions, and the aponeurosis of muscles. He will find for example in dissecting the tendons of the abdominal muscles, that they are covered with thin layers of membrane, he will mark how all muscles are covered with these, and the demonstrator will take occasion to point out the necessary consequence of inflammation or the growth of a tumour or the protrusion of a hernia upon these layers of cellular membrane.

In the dissection of muscles and fasciæ a large knife with a full convex edge, should be used: but in the dissection of nicer parts, in following the nerves for example, small and straight, or lancet pointed knives are necessary. Besides the common hook and forceps, if the student be going to enter on minute dissection he should order the hook knives and forceps for the extraction of the cataract, he cannot expect that the instrument maker will give him fit ones under an order for *dissecting instruments.*

During the dissections of the muscles, the mechanism of the joints, the classification of the muscles, their effect in fracture, and dislocation, their anatomy as it regards hernia, &c. ought to be the object of study.

When the student is master of the muscles, he enters upon the dissection of the NERVES.

While the dissection of the muscles gives ease and freedom to the hand, the dissection of the nerves gives niceness and delicacy.

During a course of dissection of the nerves, we have two subjects of inquiry, connected with our subject: the one surgical strictly; the other pathological.—The connexion of the nerves with the arteries, and the places where it is likely or probable that they may be tied when the surgeon uses his needle to secure bleeding arteries are to be noted. We must know the distribution and the precise course of the nerves of the extremities. We must observe the branches which account for the various sympathies, and the consent of parts.—We must contemplate that wonderful tissue of nerves forming the system of the viscera.—In short, if we do our duty while we are dissecting the dead body, we shall take into consideration such phenomena of the living system as may correct the inaccurate and too mechanical notions which we are apt to receive from mere dissection.

To the surgeon, DISSECTION OF THE ARTERIES is not merely most necessary, but quite indispensable. Both heart and head must be wrong when a young man allows himself to be put in situations of great responsibility, without having dissected the arteries, and thought maturely of the chances of war, and of the equally great variety of open, and oblique, and torn wounds of the great vessels, which occur in domestic life.

During dissection, there are many little operations which should be practised, and which are neglected. The introducing, for example, of probes into the ducts; as into the nasal duct, and into the ducts of the salivary glands; the introducing of instruments into the nose and throat, and into the eustachian tube: the use of the probang, and of the catheter, &c.—Knowledge and dexterity is such points often prove more useful, as being oftener required, than the greater operations of surgery. In dissection the integuments are to be preserved that they may be laid down on the parts again, otherwise in the intervals of dissection, the surface contracts a mucus, and get dry and foul· a wet cloth which by evaporation may keep the body cool, is indispensable, in the warmer days.

In conclusion, I venture to affirm, that the difference betwixt a young man that promises to be one who will improve his profession, and him who is merely tolerated as a practitioner, is this, that the one seeks every occasion to be informed of what is going forward in the dissecting room, while the other supinely does his task, and requires his certificate in writing.

The first body which the student dissects for the arteries may be done in the common way as for making dried preparations. But after he has ascertained the principal bearings as it were of the great trunks in their course; and has made himself master of the branches of the arteries, their classification, and number, and proportional size; there remains a department of study which is to bring him nearer to the circumstances of actual practice. He ought to dissect a body with the arteries uninjected, that he may know them by their appearance and relations, as they will be in the living body, where else, he will sadly feel the want of the wax to inform him of what is artery, vein, and nerve! In this department of his study he should attend particularly to the depth of the vessels, the fasciæ by which they are surrounded, the muscles which are to be separated in order to penetrate to them, the precise bearing of the artery to such points of bone, or to the courses of tendons, as may stand him good in the living body; and lastly he ought carefully to observe the relation of the artery, vein, and nerve; where he may dive boldly with the needle; where cautiously separate the artery before he ties it.

A SYSTEM
OF
DISSECTIONS.

DISSECTION
OF THE
ABDOMINAL MUSCLES.

THE dissection of the abdominal muscles is often the first that a student sees; and if it be carefully done, he is astonished to find the fleshy mass of the body separated into so many distinct parts, and is pleased with the appearance of the muscles exposed in all their beautiful variety of shapes and colours, the smoothness of their surface, and their silvery expanded tendons. But he conceives all this to be the simple exposition of the parts, not the effect of perserving labour; and if accustomed to the clear demonstration of a class dissection, has no idea of difficulty in the task. He feels the difficulty of dissection only when he takes the knife in his own hand, directed by that vague knowledge alone, which is, I fear, too common, and which consists more in a facility of repeating descriptions, than in a precise and clear idea of the situation of the parts. To begin a course of private dissections with such light ideas of the difficulty and importance of the task, and so poor a notion of practical anatomy, must produce in the student that disappointed and irritated state of mind, which is but ill calculated to carry him on with perseverance. He will find that there are many little observations to be made, and much accurate knowledge to be acquired of the appearance of parts, of vessels, of cellular substance, fascia and tendons, before he can go on confidently, and be sure of the course of his knife.

No dissection ought to be begun without maturely considering the parts which lie concealed, and all that is most worthy of labour. Following this method, I shall first describe the general outline of the parts to be dissected; and, secondly, the order of the dissection, and the points that ought to arrest attention.

FIRST STAGE OF THE DISSECTION*.

In the first dissection there is only one muscle on each side of the belly to be dissected; for the outer oblique muscle covers all the others.

The obliquus externus abdominis arises by triangular fleshy slips from the lower edge of the eight lowermost ribs, its muscular fibres proceed downwards obliquely over the cartilages of the ribs, and also obliquely downwards over the free space betwixt the borders of the chest and the spine of the ilium. Terminating its muscular part abruptly, it sends its expanded tendon over all the fore part of the belly, and is inserted into the spine of the ilium, into Poupart's ligament, into the os pubis, and into the whole length of the linea alba, which is only the interlacing of this with the tendon of the muscle of the opposite side.

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* The reader must now be informed, that only the principal circumstances of the anatomy, are described here; he ought to read this before dissecting, and if during dissection he requires the origin or insertion of muscles, or the name of an artery or nerve, he can consult the appendix.

To make an incision from the sternum to the pubis through the integuments, make a second cut in a semicircular direction over the ribs through the integuments, covering the origin of the pectoralis major: now dissect down the angle of the flap of skin off the side of the chest; in doing this, be aware of the place of the *rectus*, and do not mistake it for the origin of the *obliquus externus*, for then you will lift the tendon of the *obliquus externus* and destroy the dissection. As you proceed with the dissection, you will find the muscle covered by a thin expansion, adhering closely to the fibres—and if you take the fat and integuments off, leaving the muscle with the cellular substance and slight aponeurosis adhering to it, you will never make a clean muscle, however carefully you afterwards dissect it. You are therefore to carry your knife close to the surface of the muscle, and to disentangle its fibres from the membranous covering and integuments, by long and regular strokes, carried in the direction of the fibre. This is the method which you ought to pursue in all muscular dissections, when there is no fascia to be exposed, nor branches of injected vessels to be avoided. But you are not to proceed in the same manner in the tendinous and fore part of the abdomen, at least in your first attempts; for you would be in danger of lifting the outer layers of this sheet of tendon of the external oblique muscle, and, led away by the appearance of a beautiful shining surface (which may be the tendons of the lower layer of muscles), destroy the beauty of the parts, and make confused and irregular work. Therefore take off the integuments in a mass from the fore part of the belly; and when you see all the general surface exposed, you cannot proceed far in dissecting off the condensed cellular substance from the surface of the tendon, without observing the confusion into which such irregularity will lead you.

In the course of this single muscle, all these points must be minutely attended to—the linea alba, the linea semilunaris, the ring of the umbilicus, and the anatomy of the inguinal ring.

To understand these lines which divide the tendon of the external oblique muscle, it is necessary to remember the situation of the recti muscles. They reach from the sternum to the os pubis. Each arises from an extensive adhesion to the outer surface of the sternum, and to the cartilages of the ribs, and proceeding down in the middle of the belly, included in an appropriated sheath, is inserted into the os pubis*. This sheath is stronger upon its outer part, because when the body is strongly bent forwards, and the surface of the belly is concave, the recti muscles, were they held only by the elastic skin, would start from their places, and make a direct line from the sternum to the pubis, and the effect of their contraction would be lost; but this strong sheath in which they are included, being composed of the tendons of the broad lateral muscles, bends as they bend, and consequently the recti acting thus in a curve, more powerfully draw the thorax towards the pubis. The sheath of each rectus muscle, as I have said, is formed by the tendons of the flat muscles of the belly, proceeding from behind forwards. These mingle their tendons more intimately together, when they reach the side of the rectus muscle, which appears externally as a white semilunar line running round in the direction of the skirts of the rectus muscle—and these broad tendons splitting again, include the rectus in their duplicature, and meeting beyond that muscle, they form the tendinous white line in the middle of the belly called the linea alba. The rectus muscle does not run unconnected in this sheath, nor does it form one continued tract of muscular fibre; but the intermediate tendons which divide it into square muscular portions, are firmly connected with the sheath, while the muscular part adheres to it by loose cellular substance. Therefore when the external muscle of the belly is carefully dissected, you can distinguish these parts: *first*, the origins of the muscle from the side of the thorax, coming down in thin layers over the ribs. *Secondly*, A stronger and more fleshy part winding round the side betwixt the false ribs and the ilium. Then the expanded tendon on the fore part of the belly divided by the *linea alba*, which is in a direct line from the pubis to the sternum, and the *linea semilunaris* running up from the os pubis in a curved line, a little to one side. In the space included betwixt these two lines, you may observe indistinctly the rectus shining blue and livid through the transparent tendon of the oblique muscle, and intersected with white interstices or ribs formed by its intermediate tendons.

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* Perhaps with more reason, we may say, the os pubis is the origin of the rectus.

Of the Umbilicus.—In the course of the dissection, the umbilical opening in the linea alba will be attended to. It is like a perforation in the united tendons united to the hard skin which is over the perforation, there is a dense cellular substance like ligament (the remains of the umbilical vessels) which fills the hole, and on the inside, the peritoneum is dense and firmly attached to the tendinous ring of the umbilicus.

The Inguinal Ring.—But the most important part of this first dissection still remains to be described, viz. the anatomy of the ring. When dissecting the lower part of the abdomen near the pubis, you find the fibres of the tendon coming down obliquely to be inserted into the ligament of the thigh; and indeed the ligament of the thigh is nothing but the strengthening of the tendons of the external and internal oblique muscles at this place, where they pass over from the ilium of the thigh, are continued into one another, and form a ligament which allows the vessels of the thigh to pass freely out from the belly*. Dissecting still nearer the pubis, just as the tendon is about to be inserted into that bone, you see it splitting, and allowing the spermatic cord to slip through its fibres, and then meeting again, its fibres cross each other, and are at the same time firmly implanted into the crest of the os pubis. This is all that can be observed of this ring in the present stage of the dissection, continuing to dissect the integuments off these parts, and a little down upon the thigh, observe the situation of the femoral artery, of the epigastric branch, of the spermatic cord, and all the parts implicated in the femoral and inguinal hernia. (See further of the anatomy of the femoral ligament, in that part of the work which contains the dissection of the thigh).

Of the Groin.—In taking off the skin from the groin, you find a confused and irregular aponeurosis coming off from the abdomen, and going down upon the thigh, apparently made up of, or strengthened by, the close intertexture of cellular substance. At this part you find it covering the femoral artery; the inguinal glands lying without it, and the vena saphæna major sinking through it to join the femoral vein. You find also, where the thigh is injected, the small arteries, viz. *inguinales* rising perpendicularly from the great trunk, to supply the glands, and the other superficial parts; you find too the external pudic arteries.

After dissecting and observing the natural texture and situation of this aponeurosis, and its probable changes in disease, sacrifice it to a more important demonstration, or leave it on one thigh, while you proceed with the dissection of the other. Thus, taking away these confused parts, expose neatly the ligament of the thigh. Dissect the artery and vein in the angle of the groin, where they lie imbedded. Then, dissecting delicately with your scissars, under the ligament, you find proceeding from the upper part of the femoral artery, two branches; the arteria circumflexa ilii, and the epigastric artery. The first of these you find running back along the inside of the ligament, towards the ilium, to inosculate with the ilio-lumbar artery; the latter is the more important, the epigastric artery. It runs upon the inside of the tendons of the abdominal muscles, making its way to the rectus muscle, on the inside of which it climbs, even till it inosculate with the internal mamary, which is the first branch of the subclavian artery. In this course it crosses the upper part of the ring, and crosses behind the spermatic cord. Now, you observe that the femoral hernia, coming down on the inside of the femoral artery, the epigastric artery and the spermatic cord must pass before the neck of the sac, so as to hinder the free incision of it when strangulated; and you see how difficult it must be to cut thread by thread exactly in the middle point betwixt the epigastric artery and the cord, especially when you recollect how different the state of these parts is in hernia,

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* Yet, I conceive that this part of the tendon should be called *ligament* for this reason, that it passes from point to point of bone, without the intervention of muscular fibre.

These are parts of such importance, that you ought to consider them in every possible light. You see that the direction of the inguinal hernia must follow the course of the cord, that it will be nearer to the pubis, and higher up: that the seat of the femoral hernia is in the flexure of the groin; and that if the hernia is not very large, and the parts swelled, the ring, and the cord from the ring to the testicle, should be free. You have to observe how the arch, which is formed by Poupart's ligament, over the vessels and muscles coming from within the belly, is filled up with fat and cellular substance, and how the vessels lie imbedded in it. You find the vein lying more towards the pubis than the artery, and the small inguinal branches of the artery rising to supply the inguinal glands; these arteries sometimes bleed profusely in opening buboes in the groin.

SECOND STAGE OF THE DISSECTION.

Having paid equal attention to the dissection of the muscles of both sides of the belly, you proceed thus: dissect off the serrated origins of the EXTERNAL OBLIQUE muscle from the ribs, and from the space between the ilium and false ribs, and detach it from the OBLIQUUS INTERNUS which lies below it. You will recollect that the obliquus internus ascends from the ilium, spreading its fan-like fibres in a direction which forms an acute angle with the fibres of the external muscle which you are dissecting off. Continue to separate the external and internal oblique muscles, till you find them firmly attached by their tendons to the linea semilunaris. Betwixt them there is interposed some loose cellular substance, which mars the beauty of the lower muscle if not carefully dissected away; and you find them connected by the branches of the arteries and veins piercing them to gain the skin and cellular substance. Observe the origins of the OBLIQUUS INTERNUS ABDOMINIS from the spine of the ilium, and apparently also from the mass of muscular and tendinous origins of the muscles of the back (you will find it very difficult to dissect its origins from the spine, as described in books). Those fibres of the muscle which originate from the back part of the spine of the ilium, run directly upwards to the cartilages of the false ribs. From the fore part of the ilium its fibres are continued more in a direction across the belly, and from its lowest portion which runs directly downwards in the direction of the external oblique, you find it sending off, behind the external ring, a delicate fasciculus of fibres which invest the spermatic vessels, and forms the origin of the CREMASTER MUSCLE.

The belly of the internal oblique muscle ends in a uniform edge, and its tendon is finally inserted into the linea semilunaris: but here it is to be remembered, that some anatomists have described its tendon as splitting into two layers, one forming, with the external oblique, the outer part of the sheath of the rectus; the other forming the inner part, with the tendon of the transversalis abdominis.

This inner oblique muscle, when dissected, should be left in its seat, and the outer muscle replaced over it. Then making an incision by the side of the linea alba, which opens the sheath of the rectus, you dissect it back towards the linea semilunaris. In doing this you must separate carefully the sheath from the tendinous bars of the rectus muscle, for at these parts they are firmly blended together. Towards the bottom of the sheath, you find the PYRAMIDAL MUSCLE running up from a broad origin upon the os pubis, to an acute point inserted into the linea alba. The two pyramidal muscles rising together, one on each side of the middle abdominal line, form a cone that is sometimes observable, shining through the strong sheath which covers them. These parts being completely dissected, return them to their former place; and having continued the dissection of the muscles of the other side exactly in the same manner, proceed after this method.

The tendon of the internal oblique muscle is to be cut from its connexions with those of the other muscles at the linea semilunaris: then dissect the muscle back towards its origin upon the spine of the ilium;

and laying it over the haunch, you have an opportunity of observing the course of the TRANSVERSALIS ABDOMINIS. You find its fibres running across the belly, more in the direction of the external oblique, than in that of the last dissected muscle. You see it arising fleshy, from six of the lower ribs, upon their inside, (which has allowed some anatomists to describe minutely its digitations with the diaphragm); and tendinous, from the mass of muscles upon the loins. It runs a little round towards the side, where the strongest part of the muscle is formed. It arises likewise from the spine of the ilium, and even from the outer part of the ligament of the thigh. It is inserted into the linea alba having previously connected itself with the linea semilunaris. It will be observed, that towards the lower part of the belly, this muscle appears deficient, and the bowels are seen through the peritoneum, the outer surface of which is covered with much confused cellular substance, and unlike its smooth inner surface, which is applied to the intestines.

SUBJECTS FOR CONSIDERATION DURING THIS DISSECTION.

These parts being thus dissected, can be demonstrated in such various views, and with such quick succession, lifting and replacing them, that they cannot fail to be effectually understood. And having carefully observed their strict anatomy, no one can be at a loss to recapitulate their general character and uses.

It may be observed in the skeleton how great a space there is to be covered from the edge of the thorax to the brim of the pelvis, and backwards to the spine; and recollecting, that in this space are contained the soft viscera of the abdomen, and that these must be sustained by an elastic and yielding covering, it will be understood how this covering, whilst it supports the viscera, and yields to and assists the operation of the diaphragm, must support and poise the whole trunk upon the pelvis; and that although the muscles of which it consists be thin and delicate, yet, having so great a lever as the edge of the thorax, while the centre of motion is at the spine, it bends the upper part of the body with great force.

The following Heads and Observations I have considered as necessary and important to press on the Student's attention.

I. The abdominal muscles are muscles of respiration. 2. They are muscles of the trunk. 3. They compress and sustain the viscera.

II. 1. The student ought to consider how as muscles of respiration, the distinction in the manner of breathing becomes a symptom of disease. 2. How we endeavour to substitute the action of these muscles, and the diaphragm, for the external muscles of respiration, in fracture of the ribs and sternum, &c.

III. 1. The question, are the viscera of the abdomen suffering an unceasing pressure? Is a very important one. 2. And when on this subject, we are called upon to consider how the effect of pressure of the abdominal muscles becomes a diagnosis in diseases of the abdomen; 3. The effect of pressure taken off by the delivery of the child, or by the drawing off of the water in ascites; 4. The destruction of herniæ as they may proceed from weakness in the tendons, or where they are brought down by powerful exertions; 5. The sympathy of these muscles with the bowels; 6. how they are early affected in tetanus, and even lacerated in the violence of the convulsion in this disease.

IV. 1. Collection of matter sometimes form in the interstices of these muscles, or in the cellular membrane on the outside of the peritoneum. 2. The nature of the sinuses which form amongst their layers should be thought of.

These are the heads of subjects worthy the consideration of the dissector. He will then comprehend how very much more is to be learned than can be taught by a porter in a dissecting room.

DISSECTION OF THE INGUINAL RING AND LIGAMENTS OF THE THIGH, WITH THE VIEW OF UNDERSTANDING THE ANATOMY OF HERNIA.

But there remains still a very curious and interesting part of anatomy to be studied: viz. the manner in which the spermatic cord, and the vessels of the thigh, are allowed to make their escape without endangering the protrusion of the viscera.

Where the tendon of the *external oblique* muscle is descending to the os pubis, it splits to form an opening for the spermatic cord. On the first stage of the dissection, to examine this opening, let the student attend to the dense layer of cellular membrane which covers it, for this membrane forms one of the coats of hernia, when it takes place here. The fasciculi of fibres, forming the sides of this opening, are called the pillars of the inguinal ring. The form of the opening is that of a very acute angle on the outward and upper end towards the pubis, it is larger and round, at their insertion into the os pubis, the columns decussate. I have used the common expression, and have said, that the splitting of the tendons forms the ring; were it so exactly, the action of the muscle would draw tight the opening, and compress the vessels of the cord: contrasted with the many minute descriptions of this part, which have been given since, I am not ashamed to transcribe what follows from p. 111, of the edition of this book, published in 1800.

"The ligament of the thigh is formed by the tendon of the external oblique muscle of the abdomen, taking a firm hold of the spinous process of the ilium, and stretching over the muscles and arteries of the thigh to the os pubis. On the outer part, as it rises from the os ilium, it is firmly tied down by its connexion with the fascia of the thigh. In its whole length, but chiefly as it approaches the pubes, it is not the rounded tendon which, from viewing it on the outside, we should expect; but it is turned in and inserted into the os pubis with a flat broad horizontal tendon. The consequence of this, is, that at the point towards which the viscera must gravitate in the erect posture of the body, it is very strongly secured: and that the effort of the viscera to protrude is not made under the arch or ligament, but above it; since the margin of the tendon spreads thus horizontally to be inserted into the os pubis.

"The spermatic cord lies as in a groove formed by the ligament as it approaches the os pubis; and as the extremity of the ligament forms the lower pillar of the ring, an exit is, by a peculiar yielding or twisting of its more outward fibres, allowed for the cord, without diminishing the strength of the femoral ligament, which, by its horizontal sheath stretching backwards, is firmly inserted into the bone. Thus the spermatic cord is not exposed to the compression of the two pillars of the ring; for as the lower pillar of the ring is the extremity of the femoral ligament, as from its connexion with the bones it is immoveable by the action of the abdominal muscles, and as this lower pillar holds the cord in a kind of flat groove laid horizontally on the os pubis, its outward fibres only yielding to allow the cord to escape, the consequence is, that the upper pillar (which spreads its fibres on the outside of the lower) does not, when made tense by the abdominal muscles, compress the cord against the lower one. On the other hand, the security of the abdominal ring depends upon the obliquity of the passage, and upon the pressure of the viscera not being made in the direction of the cord, but laterally."

Now let the dissector make an incision from the *linea alba* two inches above the pubes to the lower spinous process of the os ilium, through the tendon of the external oblique muscle: he has then to dissect down the lower part of the tendon, to observe, the internal apparatus of the spermatic passage. Here he may observe the course of the *internal oblique*, he will find a few fibres of it descending over the cord, to form the cremaster muscle; following the lower edge of the internal oblique muscle, (if the subject be a remarkably strong male,) he may find a small tendinous margin, obliquely crossing the cord, but generally the muscular fibre only is over the cord.

I may now remark, that in the dissection of these natural passages, as in the dissection of hernia, we must feel before we cut, we must gently insinuate the finger amongst the cellular membrane, then we feel what really gives resistance and by clearing the fat from around it, we may see the guard upon the passage, or the ligament or fascia, which may eventually strangulate. Had this been always attended to, I verily believe, that it would have done much to have kept this subject to the simplicity of truth.

Upon freeing the vessels of the cord from the margin of the internal oblique and the cremaster muscle, the length of this oblique transit of the spermatic cord is apparent; behind the spermatic cord a bed of fat is seen; behind that, the epigastric artery is found passing across the cord.

Now, I have a circumstance of the anatomy to point out, of much importance. I am going to object to Mr. Cooper's history of the internal ring. The subject is before us! I cannot misrepresent, though I may misinterpret. Let the profession determine, whether I do this in enmity to one, who most liberally bestows his praise on others, or from that commendable spirit of investigation which it is my duty to recommend and enforce with my pupils. When the internal muscle is dissected off the cord, there is behind the muscle a layer of cellular substance, which surrounds the cord, in which the *vas deferens*, and vessels of the testicle, descend under the peritoneum and scatter to their destinations: on the inside of the *vas deferens* the epigastric artery and its sheath of cellular membrane will be felt. Here is the internal ring of Mr. Cooper. Instead of this condensed cellular membrane, he describes a fascia having a slit to allow the spermatic vessels to pass. Mr. Cooper says, that this fascia is the guard against hernia, but admits that in some subjects, it appears as condensed cellular membrane only. It appears to me, in its natural state, not strong enough to cause strangulation, and especially as it is a guard against hernia, so will hernia take place where it is weak only. In my last edition, I have said, that "I have found in operating on inguinal hernia, that the contraction was not in the ring, but in the peritoneal sac, fully two inches within it." Ap. p. 5. This I still hold as the true opinion; when the peritoneum is pushed over the spermatic vessels, by the protrusion of an intestine, it passes under the inner muscles, and around upon the outside of the epigastric artery. The epigastric artery is pushed inward, the cellular membrane accumulated by this yielding, is pressed and condensed: but sometimes it will not allow the further shifting of the neck of the hernial sac inward, and the condensation and thickening of the peritoneum and cellular membrane are such as to form, indeed, a ring, which may strangulate the gut; and I may add, though this is no place to enter more fully into the explanation, the sudden turn which the intestines takes round the artery, is the cause of the strangulation.

When Mr. Cooper says, surgeons have very generally believed that the aperture was continued into the abdomen immediately behind the ring, he does great injustice to the profession, and pays a poor compliment to the surgeons with whom he is more immediately connected.

When the student has made this dissection of the ring from without, he may take an opportunity of laying down the whoe flap of the abdominal paries over the thigh, and examine the ring by lifting the peritoneum from the inner layer of muscles —here he is to distinguish the fascia, which comes up from the iliacus internus, and lines the abdominal muscles, then tracing the spermatic vessels and the *vas deferens* through this fascia, he has to determine whether or not it be strong enough to account for the strangulation of hernia, whether it deserves the name of fascia, or layer of cellular membrane.

OF THE DISSECTION OF THE FEMORAL LIGAMENT. —Another very curious piece of anatomy must be studied, before we leave the consideration of the abdominal muscles.

The dissector makes incisions upon the integuments of the lower part of the belly and top of the thigh. In taking the skin from the tendon of the external oblique muscle, he has to observe a thin but pretty firm web of cellular membrane. It is very useful to observe this membrane, but not very accurate to call it fascia or aponeurosis*. It will be found to cover the ring and spermatic cord, towards the pubis. Towards the outer and upper part of the thigh, it mingles with the *fascia lata.* and on the middle of the thigh, it is dissipated and lost in the fat glands and cellular membrane, which lie over the femoral artery and vein. Having dissected the *fascia lata,* which is on the outside of the thigh, and observed the manner in which it mingles with the sheath of the great vessels, and turns in to unite with the femoral ligament, he may open the sheath. In proceeding to dissect away from the groin the glands and fat, we shall find a few delicate superficially distributed nerves coming from under the ligament of the thigh. We shall find also, that the cellular membrane which surrounds the great vessels forms a condensed bed, independently of an aponeurosis upon the subjacent muscles. The inner surface of this cellular membrane is strong from the interlacing of fibres. It covers and invests the great artery and vein. The same condensed cellular membrane is continued behind the vein and artery; and by pulling up these vessels, after dissecting it from before them, the branches may be seen piercing it like the vessels of the heart going out from the pericardium. All the vessels in the body are more or less supported in this manner by sheaths of cellular membrane; but it is at such places as this in the groin that it becomes a great object in surgical anatomy.

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* The term *fascia* should be confined in its signification to the sheaths, which cover, and as it were, swathe the muscles of the limbs. *Aponeurosis*, means the tendon of a muscle spread out into a membrane; but now the difficulty is to say, which is aponeurosis which a web of common cellular membrane? however, if we be willing, we may distinguish a tendinous expansion by the silver-like brilliancy of the fibres, while the layers by membrane, composed of the common cellular texture condensed, want this splendour.

Now the dissector has occasion to lay aside his knife, and with the point of the finger to feel the connexion betwixt this sheath of cellular membrane and aponeurosis, and the ligament of the thigh; in endeavouring to push his finger up into the belly by the inside of the vessels of the thigh, he feels the sharp edge of a ligament, when he pushes his finger deep and again withdraws it, the circular edge of this ligament, can be seen. I have for several years demonstrated this as the part strangulating in crural hernia: such of my pupils as belong also to the Borough school, insist upon something more. If there be, I stand corrected; but if this be claimed as a discovery by any man, I pointedly object to it. The ground for drawing my pupils attention to this has been this. They have said, Since the cord lies in the groove formed by the lower part of the tendon of the external oblique, is not the cord in danger of being cut in the operation for femoral hernia? My answer has been, so it would appear, if the surgeon was to take his notions of the state of the parts in hernia, from the clean dissection of the Poupart ligament: but when he comes to operate, and puts his finger into the neck of the sac, he feels a sharp edge of ligament which extends from the Poupart ligament.

Again, in substantiating the explanation of the cause of strangulation, viz. that for the most part, it was not the narrowness of the opening under the ligament, but the sudden angle of the gut when forced out from the groin and made to ascend on the face of the abdominal tendon; I have had occasion to demonstrate this ligament as causing the sharpness of the angle.

In the internal view of the ligament of the thigh, there is a difference in my manner of demonstrating the connexions of the tendons of the abdominal muscles, which I state with diffidence after the very full investigation of this piece of anatomy by others. In the first appearance of the psoas abscess in the groin, and the tumour of the femoral hernia, there is a striking difference which long since made me endeavour to discover the cause. I have accounted for this from the insertion of the *psoas parvus*, where it was present, and from the attachment of an aponeurosis, which I have observed going off from the psoas magnus, where there was no lesser muscle. The psoas muscle is described as being inserted into the os pubis or the junction of the os ilii and os pubis, and as being a muscle which assists the psoas magnus, my observation has led me to describe the psoas parvus, as a muscle guarding the connexion of the abdominal muscles; and when this muscle is wanting, I have shown the going off of a fascia from the psoas magnus, which connected itself with the inner edge of the ligament of the thigh, so as to close the abdomen, and, as I have alleged, excluded the illiac vessels from the abdominal cavity. Hence, I have explained, that pus descending from vertebræ, passes on the outside of this fascia or aponeurosis and by the side of the iliac vessels, but when hernia takes place, it is on the inside of the iliac vessels, because on the inside of this fascia. Further, when I have taken occasion to shew the manner in which the abdominal viscera were enclosed and supported; I have never failed to mention the psoas muscles with the abdominal muscles, the diaphragm, and perineal muscles.

After the dissector has attended to these connexions of the psoas muscles, with the abdominal muscles, he ought to dissect and examine the inner edge of the ligament of the thigh, and the termination of the tendon of the rectus.

DISSECTIONS

OF THE

VISCERA OF THE ABDOMEN.

FIRST DISSECTION.

Of the Manner of opening the Body, and observing the general Situation of the Viscera.

As the great use of dissection is to acquire the knowledge of the parts in the living body, it is proper, before opening the belly, to read the general description of the parts; to learn the boundaries of the abdomen; the situation of the diaphragm, encroaching upon the cavity of the thorax; the track of the intestines; and the place of the more important viscera;—how the liver and stomach are received within the margin of the ribs, and guarded by them;—how the arch of the colon winds round under these; and how the small intestines are collected in a group under the navel. It is of importance to mark the situation of all these parts, and to conceive which would be wounded by pointed instruments, pushed in various directions. A degree of accuracy in the knowledge of the seat of the viscera will thus be acquired, which is of the greatest use both to the physician and surgeon.

In opening the belly*, if the operator be not too finically inclined, a simple crucial incision is made; one cut from the scorbiculus cordis to the pubis, keeping the left side of the navel; and another crossing it from the spine of one ilium to that of the other, coming below the navel. In doing this, the only care should be to avoid cutting the intestines, by raising the integuments from the viscera, after the first puncture. Having thus laid open the belly, it will be seen whether the preconceived ideas of the situation of these parts be correct.

In private dissection, when the abdomen and breast are to be opened, one incision from the throat to the pubis will lay open both cavities sufficiently.

The following are the points to be observed, and which will lead, without confusion, to a full demonstration of the whole.

1. The GTEAT ARCH OF THE COLON, mounts up from the os ilium of the right side, crosses the belly under the edge of the liver and brim of the thorax, and descending again upon the left side, sinks under the small intestines, and rests upon the wing of the os ilium; thus surrounding the small intestines, which lie together in the middle of the belly.

2. The STOMACH will be found in the left hypochondrium†, retired under the ribs, and covered by the arch of the colon.

3. The OMENTUM will be found proceeding from the stomach and colon, which lie contiguous, and stretching down over the small intestines, a delicate and expanded membrane, loaded with fat.

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* I speak here, as if another body were bestowed on this demonstration; but there is no necessity for it.

† Meaning the space under the cartilages of the ribs.

4. The liver will be seen with its edge under the margin of the ribs, and towards the right side.

Such is the general appearance upon the first opening of the abdomen. But as one part of the intestinal canal may happen to be more inflated than another, this regularity will sometimes be disturbed. The stomach may be distended, and the colon contracted and empty; consequently, instead of the colon being the prominent part, it may have subsided, and be scarcely distinguishable from the small intestines. while the stomach may push out its sides from under the liver and the ribs of the left side: or perhaps the stomach and colon may have both receded, by the expansion of the smaller intestines. Now, in this state of the intestines, if an attempt be made to unravel them with the hands, there is every probability that they will be tumbled into greater confusion and disorder. It should be remembered, that in the examination of all these parts, the colon is the sure guide; for the caput coli is fixed down by the peritoneum to the loins, upon the right side; and from this the colon can be always traced up under the stomach, and above the small intestines. This transverse portion is called the arch of the colon, and if you puncture it, and introduce a small blow-pipe, and blow it up, then every thing seems to take its true place. As the colon swells up, it shews its ligamentous bands, and the cells so peculiar to it. It is seen rising before the stomach, descending upon the left side, and under the small intestines, and finally tied down by the peritoneum to the loins upon the left side, forming at this place the sigmoid flexure of the colon, which is the last portion of this gut. From this point to the anus, the continuation of the intestine is the RECTUM.

In this first display of the viscera, there is a very partial view of the intestines: only a part of the colon, jejunum, and ilium is seen; and to trace the whole length of the alimentary canal, this natural appearance must be deranged.

COURSE OF THE INTESTINES.—Having found the great curvature of the stomach, and the arch of the colon connected by the omentum, separate them, by detaching the omentum from its connexion with the colon, and lay the great intestine down over the small intestines. You then find the stomach lying obliquely across the upper part of the belly, towards the left side, a conical bag, bent upon itself; so that the two ends approach, forming on the under side a greater and on the upper side a lesser curvature. The greater curvature presents itself in this view of the parts. The cardiac orifice, or entrance of the œsophagus, lies out of sight; and even the pylorus, the lower orifice, recedes out of sight when the stomach is distended. Towards the left side, under the ribs, and hanging on the great curvature of the stomach, you find the SPLEEN of a dark and livid red colour. You see the DUODENUM, the first intestine, taking a turn upwards from the pylorus, stretching a little to the right side, then turning upon itself, and descending under the mesocolon towards the right kidney. Observe how it is bound down at this point; observe also its situation with regard to the stomach and liver, and arch of the colon; and remember that it is here within this space that it receives the pancreatic and gall ducts, and from its size and the circumstance of these secretions being poured in here, this has been called *ventriculus secundus*. Neither of the ducts can be seen in this stage of the dissection, the pancreas itself being obscured in the cellular substance at the root of the mesocolon, but you may feel it under the stomach, a hard conglomerated mass, stretching directly across the spine. The extent of the duodenum is from the orifice of the stomach to the place where the gut emerges from under the mesocolon. It lies before the emulgent vessels, before the aorta, and upon the last vertebra of the back. It is larger than any of the other small intestines, and sometimes is very greatly distended.

Turning up the colon and omentum, fixing them over the brim of the thorax, and pushing down the small intestines towards the pelvis, you find the duodenum coming out from under the colon, but still tied close to the spine by the peritoneum, or lining membrane of the abdomen. After a little space, the intestine extricating itself from the ligamentous folds of the peritoneum, is seen rising up, and coming forward and is called the JEJUNUM.

You have now to unravel the small intestines, which lie below the arch of the colon, as they at first present themselves to you. The small intestines are the duodenum (which you have already examined), the jejunum, and the ileon. These two last comprehend the whole length of the small intestines below the mesocolon, the lower end of the ilium terminating in the caput coli, or beginning of the great intestines.

The JEJUNUM, is so called from being found more empty than the ileon; but this must not be trusted to. It is said also, that it is of a redder colour, and more vascular and more abounding in the valvular processes of its inner coat; but this distinction may be rejected with safety, as authorised by Haller. In prescribing the limits of these two intestines, anatomists are reduced to the necessity of supposing them to be divided into five parts; two of which they give to the jejunum, and three to the ileon; which, showing the necessity of an arbitary division, is thereby decisive of its inutility. It is sufficient to observe, that these small intestines may be pretty regularly divided into two masses, especially when inflated; that the upper portion, and that more to the left is the jejunum, while the lower is the ileon; and that the situaton of this last exposes it more to hernia, especially on the right side. Very generally the portion strangulated in hernia of the right side, is about a foot distant from the caput coli. Where the ileon enters the caput coli, there is a soft pendulous projection of the inner coat, forming a valve at the termination of the ileon. When the caput coli is inflated and dried, this valve appears like two transverse membranes, standing obliquely across the intestine, the one projecting over the edge of the other; matter endeavouring to pass from the large intestines into the ileon, shuts the transverse slit.

The GREAT INTESTINES form the last division of the intestinal canal. Tracing the intestines according to the course of the food, the first turns, or the convolutions of the portion nearest to the pylorus, are situated further down in the belly than the last turns of the intestines; and these you find even lying contiguous to the stomach, as the great arch of the colon. The great intestines differ in their functions and use from the others; and seem to be the receptacle of the matter which has already run through the more active small intestines. They form few convolutions; but being very capacious, although short, they fill a great space in the belly. They are commonly divided into the CŒCUM, COLON, and RECTUM; but it is surely better to divide them into the colon and rectum, and to subdivide the colon, as consisting of parts having a variety of shapes, and very different in their situation, into these three portions: First, the CAPUT COLI where the colon is tied down to the loins of the right side, comprehending the valve of the ilium, the cœcum, or properly, the beginning of the colon, and the appendicula vermiformis lying in the space under the right kidney, and in the natural situation of the parts, hid by the covolutions of the intestinum ilion. Observe then upon the outer side of the cœcum a little appendage, like a twisted earth-worm, and thence called *appendicula vermiformis.* Secondly, from the caput coli you trace the colon, mounting upwards over the face of the kidney, and connected with it by cellular substance. A little further up, you find it tinged with the bile (shewing that it has lain contiguous to the gall bladder), and then going across the upper part of the belly, forming the great arch of the colon. In this part, and its whole course, you will observe its peculiar shape, notched into cells by the ligaments of the colon; which, running in the length of the gut, slip their fibres into the interstices of these cells, and seem to form them by constricting the gut. Thirdly, the colon then descends upon the left side, and going backwards under the stomach and spleen, into the left hypochondrium, and then descending over the kidney of this side, it is connected with it, and is again tied down, but less perfectly than on the right side, forming some remarkable turns out ofthe general direction, and this part is called from the SIGMOID FLEXURE of the COLON. The last division of the intestinal canal is the RECTUM. Drawing aside the intestines, which rest in the hollow of the pelvis, you find the great gut continued down from these convolutions directly, (as its name would imply) to the anus, before the sacrum, and inclining to the incurvation of that bone.

The LIVER.—Replacing the intestines, you have to observe the situation and general figure of the liver. You find the upper surface convex, answering to the concavity of the diaphragm. The under surface is irregularly concave, answering to the parts it has to receive; it is thick backwards, and on the fore part laps over the stomach and colon with its thin edge. Its ligaments rather connect it with the neighbouring parts, than support it: and these connexions are disposed so as not to interrupt its gentle motion in respiration, but tie it to the diaphragm, the moving part.

The PERITONEUM.—A subject which ought to be studied in this the natural situation of the bowels, is the peritoneum, and the knowledge of this membrane must include much of the general anatomy of the abdomen. It has been invariably the custom of anatomists to pay great attention to the course of membranes, not only in the belly and breast, but in the more delicate organs, and to trace them in all their windings, deriving one inflection or process from another. But one may easily conceive how all the investing membranes or surfaces of the viscera and muscles, and of all the variety of parts contained in the belly, were formed at the same time. And here in the abdomen all the surfaces of the intestines, of the liver, of the parietes of the belly, or inner surface of the abdominal muscles, have one common nature. They are all smooth, polished, and continually exuding a serous fluid, which allows one part to glide easily upon another, and to lie in contact without adhering. And as the contents of the belly, though all within one common cavity, do not lie loose, but are attached, the whole surface must be continuous. Now every part of the body, as it differs in structure or use from that to which it is contiguous, is separated from it by a substance differing somewhat from both, viz. the cellular texture. This substance is elastic, dividing one vessel from another, and one muscle from another; without which there would be no action allowed in vessels, nor motion in muscles and their tendons; but the whole body would remain a solid and inactive mass. We find in the belly (as in the stomach and intestines, and in the bladder) one layer of membrane separated from another, where they differ in structure and economy, but the outer layer or surface of all the contained parts in the belly has a common nature, which differs in its properties from the parts which it covers, whether the muscles of the abdomen or the intestines, and it is separated from them by interstitious cellular substance, and appears, upon careful dissection, a distinct membrane, viz. the peritoneum. If this is to be considered in the light of a separate membrane, involving all the bowels in its doublings, then its demonstration is to be followed in this manner: it is seen lining the abdominal muscles which have been laid back, it can be traced from the lower flap over the os pubis, reflected over the bladder, and again running down betwixt the bladder and rectum, then embracing the rectum, and connecting it to the spine, and while it gives easy access to its blood vessels, involving them in its duplicature. When you put down your hand behind the bladder, you find that you can proceed but a little way; your finger is impeded by the menbrane being reflected from the bladder upwards over the rectum, thus separating the viscera of the abdomen from the pelvis There is no cavity, as it is called in the pelvis, but the parts are connected by loose cellular membrane, and it is the motion of the abdominal viscera which requires the general smooth and investing membrane. In the upper part of the abdomen, is seen in the same manner the peritoneum continued from the muscle over the inside of the ribs, and under surface of the diaphragm; reflected from the diaphragm upon the liver: and forming the broad or middle ligament (ligamentum suspensorium), which reaches down from the integuments of the abdomen, and is inserted into the upper surface of the liver, in a line with the great fissure which is on the lower surface. You may observe in the edge of this, a hard round ligament, better felt by the fingers than seen; it proceeds from the umbilicus, and is the remains of the great umbilical vein, which in the fœtus came from the placenta. Drawing aside the colon and small intestines of the right side, to have a view of the right lobe of the liver lying deep in the hypochondrium, you may see the lateral ligament of this side, thin but ligamentous, and formed like the others by the peritoneum reflected from the surface of the diaphragm. And when you look up under the diaphragm, holding down the liver, you see an extensive attachment betwixt them, formed by the peritoneum which, including a circular portion of the liver, is called the coronary ligament of the liver.

It cannot be conceived that these ligaments support the weight of the liver, they are in themselves delicate, and all the ligaments and processes in the belly, partaking of the nature of the peritoneum, are gradually elongated upon the slightest extension. But were they in every respect calculated to support the liver, their insertion into its soft substance would be unable to bear its weight; it is the equable pressure of the abdominal muscle that supports it, and all the viscera of the belly. And it may be observed, that the great peculiarity both of the abdomen and thorax is, that the lungs in the one, and the intestines in the other, containing each a proportion of air, give a uniform and elastic resistance, while the vessels in the limbs and other parts of the body act under a more incumbent and sluggish weight.

The MESENTERY, MESOCOLON, and LIGAMENTS of the COLON, are formed thus: the lining membrane of the inside of the belly, when it comes to the spine, mounts over and covers all the parts that lie contiguous to the spine; investing them on the fore part, but leaving them at their attachment to the back, involved in cellular membrane. In this manner are situated the kidneys, the great vessels, the thoracic duct, &c. These may be considered as without the peritoneum. But indeed all the contents of the abdomen may be considered as equally without the peritoneum, for they lie as if they had forced themselves forward from the connexion with the back, carrying the peritoneum before them. The intestines are in this situation; the peritoneum coming off from the back bone and loins, on either side of the vessels which go to supply the intestines, includes the vessels in a double membrane, the mesentery, which, when it reaches the intestines, separates again, and, stretching over the gut, forms its outer or peritoneal coat. In the same manner is formed the mesocolon of the great intestine, answering the purpose of the mesentery of the small intestines.

Yet this method of explaining, although in a certain degree it may give a clear and precise idea of these parts, may be carried too far, and become intricate. The OMENTUM, that delicate, and in many instances pellucid membrane, loaded with much fat, which first presents itself on opening the body, is described by anatomists as consisting of four layers; for being a double membrane (which can be demonstrated by blowing it up), and each of the membranes being formed by the peritoneum coming off in a double layer, the one from the stomach, and the other from the arch of the colon, they thus reckon it, as consisting in all of four layers of membrane. From its connexions, this the great omentum has received the name of gastro-colic omentum. Its connexions and double layers are best demonstrated by introducing a large blow-pipe under the great vessels going to the liver, pointing it towards the left side, and blowing it up. It may be traced on the left side to the spleen. which it connects with the obtuse end of the stomach running round to the œsophagus, and being continued even into the lesser omentum. This lesser omentum is found by laying down the stomach, and exposing the under surface of the liver. It is a membrane of the same nature with the last; running back from the lesser curve of the stomach, reaching from the cardiac to the pyloric orifice, and spreading backwards to the liver. It forms thus a web, concealing the little lobe of the liver and the pancreas. In injecting the stomach, this membrane ought to be carefully preserved, as it is supplied with arteries from the coronary arteries of the stomach. There is yet another division of the OMENTUM, the omentum colicum, which is continuous with the great omentum, arising from the right side of the colon, and ending conically above the cœcum. The smaller masses of fat which are attached to the great intestines are the appendiculæ epyploicæ.

I.

EFFECTS OF DISEASE IN DERANGING THE ABDOMINAL VISCERA.

On this subject it is of importance to study the nature of inflammation, of adhesions, and suppuration, and the almost uniform consequence of disease upon the peritoneum. It will be easy, when this knowledge is acquired, to unravel the diseased viscera, which, without it, must appear confused and intricate.

Active inflammation should be distinguished from turgidity of the vessels; for often a fulness of the veins mechanically produced, is described as an active inflammation in the brain and in the pleura, and still oftener in the abdomen. In dropsy, in violent distention of the intestines, in tympanites intestinalis, and after child-bearing the veins of the intestines and peritoneum are often found distended with blood. But in real inflammation, there is a suffused redness, the peritoneum becomes thickened, pulpy, and less transparent, and the blood is also of a brighter red colour.

As the eye becomes dry and painful and inflamed when the eye-lids are forcibly kept open and prevented from spreading the secretion upon its surface; so, when the enveloping membrane of the viscera is exposed, the natural secretion of its surface is destroyed, and the surface is irritated and inflamed. Or, by inflammation from any other cause, the secretion is destroyed; the parts lying in contact are no longer kept separate; the secretion is changed into a deposition of coagulable lymph and they unite.

Adhesion is produced in the peritoneum and intestines in a wonderfully short time: and the smooth membrane, when it is torn from its new connexions, appears cellular; or, upon being cut, thickened and solid; or if the surface have undergone severe inflammation (without being allowed to form these adhesions which are so frequently the consequence of inflamed peritoneum), its surface becomes ragged, and numerous floculi of new membranes are formed upon it. When the inflammation has been violent as in strangulated hernia, purulent matter is sometimes found lying on the surface of the intestines. In long continued chronic inflammation, the peritoneum is covered with opaque white bodies.

In diseases where inflammation has spread among the viscera, it is generally understood that the peritoneum is the original seat of the inflammation. And according to this idea, it appears upon dissection, that the intestines do more readily than the muscles participate in the inflammation of the periptoneum. The muscles are indeeed guarded in some measure by the loose cellular substance, which separates them from the peritoneum. But this does not satisfactorily account for what in the above view appears to be so great a difference between the sympathy of the intestines and that of the muscles with the peritoneum. The true explanation seems to be, that the disease or inflammation is in general communicated, not from the peritoneum to the intestines, but from the intestines to the peritoneum. It is the disease of the intestines which produces those deadly symptoms that are said to mark inflammation of the abdominal cavity; however, there are diseases in which the peritoneum is peculiarly the seat of inflammation, and this inflammation of the peritoneum, produced by any external cause, is dangerous by propagating its inflammation to the bowels, or from the great extent of the cavity, the interminable surface, as it were, along which the inflammatory action is propagated.

In investigating the seat of disease in the abdomen, the dissection is very simple. These are the stages: Make a crucial incision, at once laying open the cavity; or, if in a female, make your incision so as to leave a triangular flap to fall over the parts of generation, by continuing your longitudinal cut no further than the umbilicus, and from that point, making an oblique incision on each side, towards the projecting point of the ilium, forming thus three triangular flaps. Then observe whether the parts are in their natural situation; examine the omentum, the stomach, the spleen, the intestines, and then the liver and gall ducts. Then separating the stomach and colon, connected by the omentum, raise the stomach, and examine the pancreas, cutting up the adipose membrane, examine the kidneys, by making a section of them. Then following the ureters, examine the contents of the pelvis, &c. In making up your case, the diseased appearance, will of course be first described, but the viscera in general, which may be natural, should be enumerated, that the reader may not imagine things were forgotten. The history of this dissection should be kept perfectly pure of all reasoning.

This, in general, is the order of a dissection of these parts for the investigation of the cause of death; but it is proper, in the following remarks, to keep to the order of the demonstrations already given. I shall first, therefore, consider those viscera which lie in the upper parts of the belly, and are seen upon folding down the colon and small intestines.

II.

DISEASE IN THE OMENTUM.

Under the title of *omentum extra sedem*, there is no end to the varieties to be described, but in fact, this is the explanation. It is a membrane in its natural state loose and floating, reaching into the furthest corners of the abdominal cavity; and if there be in any part an inflammatory tendency, this membrane is prone to assimilate with the action and to adhere. Thus if there be disease about the pylorus, there the omentum is collected and massed into a tumour; if there be obstruction of the colon, the omentum forms tumour there; if there be disease in the womb, though seated deep in the pelvis, this membrane will have formed an attachment to the fundus of the uterus; if there be a hernia it is more than an equal chance that the omentum forms a part of it. From this disposition to attach itself and to assimilate with disease it is of all the parts in the abdomen, the least frequently to be found in the natural state. We find it inflamed, gangrenous, morbidly loaded with fat, wasted as by putrefaction, scirrhous, steatomatous, entangled with hydatids, and its cavity distended with fluid.

III

OF THE DISEASED APPEARANCES OF THE STOMACH.

1. The stomach and spleen being minutely injected with size, they are to be taken out and carefully examined. Notwithstanding the very peculiar and important office of the stomach, in performing the first change in the assimilation of the food, yet no complicated apparatus appears; it is a membraneous bag similar to the other parts of the canal. 1. The distinctions of the great and lesser extremities, are naturally dwelt upon. 2. The attachment to the former of the spleen by the *vasa brevia*, is noted as demonstrating this to be the place of the most important function. 3. The muscular coat of the stomach will of course be traced from the œsophagus, and the motion of the stomach considered in digestion, in rumination, in the borborygmus; its sympathy with the diaphragm in vomiting, &c.

4. Then the other coats will fall to be dissected, the seat of inflammation considered, as for example, how it may be confined to the villous coat, or be evident also in the vascular coat. 5. If the dissector ever means to consider himself as entitled to speak before a jury, he will be led to consider the distinction of ulceration of the inner coat of the stomach from poison, and that destruction and softness the effect of its own juices, for during life, the property of life in the coats of the stomach, prevents the action of the gastric juice, but if a person be suddenly cut off during health, nothing prevents the secretion of the stomach, which is intended for the food itself acting on the stomach. 6. He will think of this necessary effect of acid matter acting on the living stomach, viz. that there will be vascular action excited, and inflammation or extravasated blood around the spots. Thus, I have seen death from swallowing caustic alkali, where with the blackness of the inner surface, the substance of the stomach was much thickened; and so also in poison of concentrated acid there is the same appearance. In those dying from swallowing an inordinate quantity by spirit I have found the inflammation, attended with remarkable spots of extravasation in the coats. In consequence of the poison of arsenic, with the erosion, there is much redness from inflammation and extravasated blood. 7. In hydrophobia, from the bite of a rabid animal, I have found large spots of an inflammation like erysipelas about the cardiac orifice. 8. In cancer of the stomach, there is sometimes an appearance of glandular thickening of the walls of the stomach with ulceration on the inside it is sometimes like soft cartilage on the inside, or there is a fungous or cancerous tumour, hanging into its cavity from the coats of the stomach. 9. I have also met with that very peculiar ulceration of the stomach, which leaves an opening in its side as by the thrust of a sword, and by which the contents of the stomach escape. When

this has been the case, I have found the matter which had escaped, confined to the upper part of the belly by the adhesion of the colon to the margin of the chest. 10. Distinct scirrhous tumours are occasionally formed in the coats of the stomach. 11. Scirrhous thickening of the pylorus, I have often seen but not a proper stricture, though it sometimes occurs. 11. The distention or the contraction of the stomach though great in a degree, we are not to consider as organic disease.

In examining the body, it will be observed how the stomach and spleen may be wounded by a thrust apparently into the thorax; or how the lungs and stomach, or lungs and liver, may be thrust through at once. It may also be observed, how the stomach and liver lie before the diaphragm, where it goes obliquely down upon the back part of the abdomen; and how they lie contiguous to one another. The effect of hydrothorax, in pushing down the diaphragm, and depressing these parts—the effect of empyema too in causing the liver to protrude, and the effect also of enlargment of the liver, or distention of the stomach, upon the breathing, must all be obvious.

The stomach is commonly retired behind the colon, and under the ribs. Yet, when slightly distended, it comes further down in the belly, and assumes the place of the arch of the colon.* Therefore finding a patient with an open ulcer immediately under the scorbiculus cordis, discharging the contents of the intestines (an instance of which I have lately seen), it may be questioned whether it be an opening from the stomach or from the colon. This may perhaps be determined by observing the matter discharged, whether it be food partly digested, as from the stomach; or fæces, as from the colon, after having gone through the whole length of the canal. Or in such a case, we should have occasion to note, the sharper pain followed by inclination to go to stool, which marks the disease of the lower parts of the canal, or the pain more sickening and subduing, which marks the disease of a higher part of the canal.

OF DISEASES OF THE LIVER, DUCTS, &c.

Varieties of tubercles, are occasionally seen in the liver, as the more common brown tubercle, the large white tubercle, the soft brown tubercle and the scrophulous tubercle. The liver is sometimes found very hard and dense with its edge turned out, this is believed to be the first stage of the disease producing tubercle. I have observed a jaundice, attended with a universal spongyness and thickening of the ducts in their course through the liver. The liver is the most frequent seat of hydatids; half immersed in the substance we discover a white sac, which when open, there drops out the proper hydatid, which lay unattached within the sac. The hydatid consists of a soft somewhat transparent laminated membrane, the fluid it contains is coagulable. The general opinion is, that these hydatids are animals, and have a power of generation ; we may at one time see the coats studded with little grains or the young hydatids hang upon the inner side of the sac, or they swim loose in the fluid of the sac. Again, I have seen them, where I supposed the original sac had burst and scattered them among the viscera of the belly to form new adhesions. There seems to be considerable varieties in the hydatids of different viscera and animals. I have imagined there preceded their formation, some peculiar state or kind of action in the vascular system of the part. Hydatids have been found in coagulated blood ; I have found them in the fungous bloody tumour. I have seen distinct vesicles, formed by the inflammation following a bruise, that much resembled the proper hydatid. But in any view, we take of them, we have difficulty in concluding on their cause and nature.

Observe the situation of the liver towards the right side; how far it comes down in the right hypochondrium; and how dangerous and improper it consequently is to tap on this side, the more especially as the liver is often enlarged in dropsy. Observe, again, the close connexion of the liver with the diaphragm, and how abscesses originally formed in the liver, may, by the spreading of the inflammation, and by the adhesions with the diaphragm, communicate the suppuration to the lungs, so that the matter from the liver may be coughed up from the breast; or how hydatids originally formed in the liver, may, by the same communication, be coughed up from the lungs; or how matter in the liver, may by its natural tendency to the surface, propagate the inflammation to the abdominal muscles, and, by forming adhesions with them, be discharged outwardly. In this last case the adhesions, preceding the formation and progress of matter outwardly, the attachment of the liver and integuments is close and intimate, and the abscess points regularly, so that the operation is very easy, yet when in a mature abscess it bursts from exertion, it is apt to spread wide in the cavity of the abdomen. From the contiguity of the colon, the abscess of the liver, besides being attended with a peculiar painful feeling in the right hypochondrium, is accompanied with a sharp pain of the shoulder on the same side; it sometimes happens, that the liver is like the kidney, so little sensible, that, upon dissection there are found great abscesses where the patient during life, had no complaint. There are, in the writers upon the diseases of hot climates, some strange examples of the extensive communications of these abscesses.

After having observed the intimate connexion of the liver, duodenum and stomach, it is easy to conceive a case by no means singular, a discharge of matter into the stomach and intestines, and even a discharge of the food by the external wound, after an operation for abscess of the liver; for it has happened, that the abscess of the liver has formed a connexion, with the stomach on the one hand, and on the other, has opened outwardly upon the side of the belly. It will be seen how hydatids, getting entangled with the intestines, may be discharged by stool; and how tumours of the liver, pancreas and spleen, must oppress the stomach.

With regard to the operation for the collections of matter in the liver, unfortunate mistakes have been made. There is a case mentioned by Haller, of what he calls a spurious aneurism, in which upon the tenth rib below the scapula, and in the muscular flesh of the back, there seemed to be the pointing of an abscess, which yielded to the fingers; the patient having at the same time a slow fever, and a jaundiced complexion. They had no doubt of its being an abscess of the liver; but the patient died of violent hæmorrhagy the night following the operation. There is another case which brings home to us still more forcibly the importance of an accurate knowledge of these parts, and of a lively conception of the effects of disease upon them. In l'Hopital de la Charité in Paris, the operation for empyema was performed, but no matter flowed from the incision. The surgeon had been deceived chiefly by the circumstance of matter being spit up from the lungs, Upon dissection, they found that the matter had been originally formed in the liver, and from it had been communicated to the lungs; but that this communication, having been formed deep in these viscera, no matter could flow from the incision. In Ruysch there is another case of a country surgeon cutting into the liver, when intending to perform for the paracentesis of the thorax: and the case shows, at the same time, the possibility of mistaking enlargement of the liver with hydatids for hydrothorax. The reason of this should be attended to. When matter first distends the side of the chest, the diaphragm and liver are pushed low, but when the purulent matter finds its way into the bronchiæ, and is discharged by expectoration, the diaphragm rises and the liver follows it, and as the diaphragm rises higher in the chest, it forms adhesion to the pleura costalis. Thus it happens, that the surgeon puncturing for the empyema at the point of election cuts into the liver.

IV.

THE DISEASES IN THE GALL-BLADDER AND DUCTS.

1. Adhesion of the gall-bladder to the duodenum, stomach, or colon, is a very frequent occurrence. 2. The coats of it are found thickened and hard, or it is contracted and altogether obliterated. 3 The quantity of BILE contained in this receptacle varies much even in those suddenly killed, because the discharge or accumulation of the bile, depends upon the circumstance of the food having passed the duodenum or being yet retained in the stomach. Where there has been much irregular excitement of the bowels, as in children dying of bowel complaints, the gall-bladder is found with much bile accumulated in it. The bile is naturally of a dark yellow colour, and viscid, it may be of a green colour, without absolutely indicating disease. 4. Gall-stones are very common, especially we find a number of small dark coloured irregular concretions in the gall-bladder ; sometimes there is a large solitary gall-stone, and then it is rounded and tuberculated. The colour of the concretion varies like the colour of the bile through the gradation of black, brown, and yellow. 5. The presence of gall-stones in the gall-bladder occasions a spasmodic pain, but often

they lie without exciting the violent contractions of the gall-bladder; but if they descend from the cystic duct into the common duct, then they obstruct the bile; the bile is accumulated in the gall-bladder and ducts, then is the great pain and writhing of the body, sickness and pain at stomach, from the distended biliary passages, general languor and jaundice shortly after from the absorption of the bile. 6. Stones have been cut from the gall-bladder.—How are we to understand this? that the gall-bladder, has been greatly distended, its fundus has come in contact with the abdominal walls, adhesion and ulceration have taken place, and the stone has been picked out.

We are little acquainted with the DISEASES of the PANCREAS, scirrhus hardening of the gland, though rare, is the most frequent disease of it. Abscesses may be found in it and calculi; we cannot ascertain the presence of disease here, unless when the disease has closed the mouth of the biliary ducts.

V.

OF THE DUODENUM.

1. Its precise situation should be observed, the entrance of the ducts, its size, its function. 2. We foresee that from the mixing of the fluids here, that complaints and uneasy feelings must be very apt to occur. 3. The flatulent distention too, and great spasmodic pain in the back which it occasions may be understood from the manner in which this intestine is confined and tied down, 4. We hold in recollection the sympathy that connects the stomach and duodenum, the duodenum and liver. Thus, in the continued operation of an emetic, the bile at last appears in the stomach, though not originally there.

VI.

OF THE SMALL INTESTINES AND THEIR DISEASES.

1. As the student must have read of the lacteals and of absorption, he naturally seeks for a portion of the intestine on which the lacteals may be distinguished and injected; he examines the course of the canal, he looks for a faint white line running for about two inches in the length of the intestine, which at length making a turn runs on the mesentery. Having chosen a part of the intestine on which these vessels are most numerous, he has the arteries and veins injected with deep coloured wax injection, as of red, green, or black, and then proceeds to inject the lacteals with quicksilver. Other portions of the intestines ought to be most minutely injected with red size in the dissection of the coats, for demonstration; the peritoneum where it forms the mesentery, is to be split up, and dissected in part off the gut. 2. The muscular coat is best shown by distending the intestine and pulling off the peritoneum in shreds, and by tearing off the peritoneum, we have the circular fibres very distinctly visible on its inner surface. 3. To show the cellular coat, let the mesentery be cut short, and the intestine inverted and blown up; by this means the air gets access to the cellular texture and distends the inner coat; the intestine may be thus dried, and sections made of it. 4. To show the *valvulæ conniventes* and *villi* of the inner coat, the intestine has only to be inverted and hung in water.

VII.

During these operations, various subjects of inquiry will enter into the anatomist's mind. The nature of the peristaltic motion of the intestines in their natural function; the antiperistaltic motion excited by obstruction or too powerful or unnatural stimulus. 1. From this acquaintance with the muscular action of the hollow viscera, we come to understand the distinction of inflammatory and spasmodic pain, and the distinction of inflammation in muscular, and in solid parts.— For example, if the pain rises in paroxysms and is not fixed, it is an intestinal pain; if pressure and varying the posture relieve it, it is a spasmodic pain of the intestines; but if the pain be constant and fixed, and increased on pressure, the probability is, that it is not a disease of a muscular part, that it is not a spasm but an inflammation. 2. From the consideration of this subject, we see that most terrible of all complaints, having from the severity of the patitient's suffering, been called the *iliac passion*, or the *miserere mei* proceeds from the muscular contractions of a part inflamed. 3. We comprehend too, how it is possible for parts having no muscularity, as the liver, the spleen and kidney, to be inflamed and to pass to suppuration and almost to the total destruction of the substance, while yet the patient suffers little; such appearance of ravaging disease, is not uncommon in dissection, while yet during life the patient had no complaint in the region diseased. 4. The attention is naturally directed to the experiments, which have shown that mere irritation of the intestine will produce that very strange effect, the introsusceptio invaginatio, or intussusceptio. This gliding of a portion of the intestine within another, I often see in children who have died with irritable bowels. With them, it is not attended with inflammation. There is no adhesion and the invaginated intestine can be easily drawn out again. 5. In the introsusceptio, which I have seen in the adult, it has become an inflammatory disease. These are the appearances: on opening the body, all the intestines which are above the intussusception are greatly distended and inflamed, being of a brownish red colour, and if the inflammation has continued long, purulent matter is mixed with serum in the belly. When we lay aside the distended bowels, we find a knot of intestines, what may be called the vaginal portion of the intestine, of a pale yellow with black spots upon it, and the tract of the canal below the obstruction is pale compared with the portion above. When the included portion is exposed, it has no resemblance to the natural appearance of intestine; the accumulation is such, as to make a total obstruction in the canal, it is gangrened and perfectly black. This is a subject which would admit of a long inquiry. I will only venture to say, that Mr. Hunter, in writing his paper on this subject, has mistaken the pathological principle, and that the practice which he recommends is eminently dangerous. 6. The intestines may be obstructed in many ways by adhesions and entanglement of the convolutions; they may be strangulated by adhesions of the omentum around them, for then it gets to be of a tendinous firmness, by scirrhous contractions, by calculus within the gut, by all the varieties of hernia; and in all these cases much the same train of symptoms and the same morbid appearances characterise the disease. 7. The racking pain in inflammation of the belly, is not an idiopathic symptom of inflammation of the peritoneum, but of the action and tormina of the bowels, when excited in such a state of the parts; while often in fatal inflammation, as after lithotomy, or wounds of the viscera, there is no excruciating pain, but tenseness of the belly, faintness and languor.

In dissecting herniæ, where the inflammation of the abdominal viscera has been violent and suddenly produced, I have repeatedly found the small intestines connected more or less with one another, not only in the groin, where the strangulated gut adhered, but through the whole extent of the abdomen. But the peritoneum, which lines the abdominal muscles, I never saw connected with the intestines in this disease, unless at the part where the gut was confined in the rupture. This inflammation and adhesion of the intestines extending through the whole belly, while the general investing peritoneal membrane adheres only at the ring of the hernia, shows at the same time, that inflammation is propagated, not by the peculiar nature of the peritoneum, but by the sympathy among the intestines themselves or rather as I have explained by the excitement of the accumulated contents.—What follows relate to the vascular structure of the intestine.

VIII.

1. In Inflammation of the intestines where the obstruction has proceeded from the inflammatory state, the colour is of a brighter red. 2. Where inflammation has followed obstruction and the working of the coats on their accumulated contents, it is rather of a dark red, or brownish red ; in both cases when the inflammation approaches to gangrene, there is a dark livid red with patches absolutely black where gangrene has taken place. Once only have I found the intestines and omentum black as soot: there was not the slightest tinge of blood nor any appearance of inflammatory action. 3. The inflammation sometimes produces flocculent membranes hanging on the surfaces of the intestines ; and I have seen white spots on the intestine, but they were not pustules. Abscesses form too, but I have only seen them in the mesentery. 4. Dysentery has its seat in the great intestines, chiefly. The appearance is quite peculiar. The colour of the diseased portion is dark and motly. The vessels are very turgid but the blood is not in the vessels only but effused parts of the intestines are quite black, they are not distended. The coats are thickened, and where they are most so they will be found ulcerated within. Irregular

tubercles are sometimes in the inner surface. Masses of coagulable lymph I have found on the surface of the great intestines when highly inflamed. 5. We find from time to time a portion of the canal callous or scirrhous; this is a disease principally of the great intestines or of the orifices of the stomach, or the termination of the ilion, it is most of all frequent in the rectum. 6. Adhesions formed among the intestines, may sometimes be obliterated again, if the violence of the first stage do not prove fatal. In the dissection of a man who died after the operation for hernia, and where the inflammation had been very extensive, all the small intestines were found glued together in one or two separate masses; and those, when cut out, and a section made of them, looked like large honeycombs. Very much the same appearance occurred in another case, where the violence used to reduce the hernia without incision, was so great as to occasion mortification of the gut after it had been reduced. In other cases, where the inflammation had likewise been very great, the patient suffering long, and at last dying after the inflammation had subsided, I have found (which indeed is often met with), bridles connecting the small intestines, like the chordæ tendinæ of the heart, an inch and a half in length, slender and crossing over an intermediate convolution of the intestine, and holding it thus, as if in a noose, in imminent danger of strangulation, and in several cases since, I have seen the intestine thus strangulated. Now these strings must once have been adhesions formed by inflammation, and were probably broad and extensive at first, though now stretched out to this shape by the natural contraction of the intestines.

There is another circumstance to be attended to in explaining those broad adhesions betwixt the intestines. The accurate descriptions given of the shape of the intestines and stomach apply to them only when out of the body, or when the integuments are laid open, and the pressure of the abdominal muscles taken away. In the living body, the viscera must all be in contact with a broad and square surface: for, being contained within the abdomen, there are no interstices among them, nor between them and the general covering of the belly; and consequently they do not form (as they appear to do when dissected) complete circles, but are flat towards the integuments, and flat too on their sides, where they lie in contact with the next piece of gut.

IX.

1. Where the arch of the colon crosses the belly, it lies contiguous to the stomach; and here, communications are sometimes formed by disease. As already hinted, there is some difficulty in examining such cases; for there is much confusion often, and massing together of the parts by inflammation. For example, the peritoneum, stomach, duodenum, colon, gall-bladder and liver, are all grown together into one confused mass, shooting fibres out on all sides, and degenerating on the surface into a thick soft matter, by which all these parts seemed to be glued together. In such a case I have found an ulcer forming a passage from the stomach into the colon, which was empty; and the stomach was disfigured all round the ulcer, by irregular scirrhous tumours and abscesses." This I give to remind the dissector of the confusion which attends almost every organic disease in the viscera.

2. From the shape of the great intestines, and from their size and greater inactivity, it may be conceived how peculiarly liable they are to congestions, and the formation of balls and concretions. These accidents are peculiarly incident to the caput coli upon the right loin, and the sigmoid flexure of the colon on the left; and we find, in collections of cases, more

frequent instances of congestions in these parts than in any other part of the canal. These concretions are sometimes formed into balls of amazing size, and the intestine, contracting round, embraces them closely. They are attended with great suffering, and continued colic pains, and partial inflations of the intestines, with tenesmus and gradual exhaustion of the body. It has happened, that such balls of immense size have been disengaged from their original seat, and have appeared at the anus, and been extracted, like the child's head with forceps. They are generally formed upon some nucleus of indigestible matter that has been swallowed, as stones of fruit, bones, &c.

3. Injuries done to the great intestines, either by such congestions, or by ulcers and fistulous openings, caused by any hard substance swallowed, or the nestling of worms (cases of which are very numerous), are not so dangerous as in the small intestines, though both are equally liable in their consequences, to produce peritoneal inflammation. According to the importance of the function which any part has to perform, the derangement of its action is dangerous to the constitution, and painful and distressing; here is no better proof of the danger and bad consequences likely to be produced by the inflammation of a part, than the pain and general effect which it has upon the economy. In the great intestines, the pain is sharp and rousing; in the stomach and small intestines more heavy, and more oppressive and sickening.

4. Cases delivered as being the tympanites abdominalis, often admit of dispute. Without denying the fact of air puffing up the belly, and being contained without the intestines, or in what is called the cavity of the abdomen, it may be observed, that this can happen only immediately before death—perhaps from gangrene of the intestines, and the consequent escaping of air from them. But the accumulation of air

found in the abdomen on dissection is oftener generated by putrefaction after death; as in cases of gangrene of the intestines from hernia, in mortification after wounds, in gangrene of the uterus, &c. and even where there have been no such immediate sources of putrefaction, there is often upon opening the belly, a very disagreeable gust of air. To this source may perhaps be referred many of the tympanitic cases given by the older writers. Morgagni, upon many occasions, is too apt to overlook the origin of this air, generated by putrefaction in the body, counting it as natural and existing in the living body, and as escaping from the blood, where it counteracts the pressure of the atmosphere. For instance, he enumerates, in the history of a dissection, these appearances: The stomach and intestines were distended with air; the gastro-epiploic vein turgid with blood, which flowed out frothy when cut into; there was a hernia with beginning gangrene and bloody serum in the cavity of the abdomen: the heart was large and flaccid, with black frothy blood it; not a vein through the whole body but was distended with air and blood; the scrotum was puffed up with air, and was observed increasing even during the dissection, and the stench was so intolerable, that they were obliged to put a stop to the dissection. Now, Morgagni's intention in giving this case is not to caution his reader against describing such accumulations of air to any other cause but putrefaction; but it is to illustrate an opinion he entertained, that apoplexy was produced by air extricating itself from the blood, and stopping the circulation in the small arteries of the brain.

The tympanites intestinalis, may be said to be a common occurrence, the intestines being often amazingly distended. I have seen two turns of the colon filling the whole abdomen, and compressing the small intestines, which were thickened, red, and fleshy; the distended intestine white, and free from inflammation, withoutany obstruction or any apparent cause, for such distention unless loss of tone in the intestines. In Haller's book of Pathological Cases, there is described a tympany of a peculiar kind (and similar cases are given by Morgagni, and in other collections); between the muscular and external coat of the intestines the air had raised vesicles, which, when opened, stunk intolerably; and Haller supposes this air to have been forced through the coat of the intestines, and only restrained by the peritoneal coat from forming a true tympanites abdominalis; but no membrane in the living body will allow air, or any fluid to pass through it; and the coats of the intestines must have been totally destroyed before they could have allowed air to escape through them. It will be observed, that it is only by the contraction of their own coats that air or fæces can be expelled from them into the cavity of the abdomen, and not by the elasticity of the air contained in them; because, when distended by the air, the intestines being in contact with the general covering of the belly are supported by it, and were they like cobwebs they would never burst. I suspect that the air in the vesicles, in this case of Haller's also, was air generated by putrefaction; or like those vesicles which are found in brutes.

6. The worms which are found in the human intestines, are these *lumbricus teres*, *tænia solium*, *tenia lata*, *ascaris*, *trichuris*. These worms are not accidental tenants but the intestinal canal is their proper abode, how they are produced it is difficult to imagine. I believe that there is a disease previous to their production and that it is not the evacuation of these animals which will cure a patient, but a change must be induced on the intestines themselves, the state favourable to their production must be removed.

7. *Intestina fæcibus infarcta.* Such is the title of many cases on record, but I give it a place here, in order to urge the dissector to take a somewhat more

enlarged view of the principle of pathology, than to suppose that all the dreadful mischiefs enumerated by modern writers proceed from the accumulation of fæces and their irritation.

8. The lacteals are sometimes distended to six times their natural size. This I have not only seen when the mesenteric glands have been large and obstructed, but in old people where the glands were remarkably small. 2. The mesenteric glands are very often diseased in children dying about the period of weaning, they are large and full of cheesy matter ; in children at a latter period, I have found them forming a cluster as large as my fist, a soft grey coloured tumour. Why there is always a marasmus in such a case, is easily understood, since the nutritious fluids are denied admittance into the system. 3. I have found these glands full of a calcareous earth. 4. I have found them degenerated into a large bloody tumour. 5. They are often scirrhous. 6. Abscesses are not unfrequent in the mesentery, no doubt proceeding from the suppuration of these glands. 7. Steatomatous and even cancerous tumours are found in the mesentery and meso colon. 8. Hydatids adhere to the mesentery.

SECOND DISSECTION

OF THE

ABDOMINAL VISCERA.

After having carefully examined the natural situation of the viscera, and considered those varieties in their appearance which are likely to disconcert the dissector in investigating morbid anatomy, the intestines are to be removed in that order which may illustrate and confirm the ideas already obtained.

But when the object is a knowledge of the blood vessels of the viscera, the injection must be made before the intestines are roughly handled, or the delicate membranes of the omentum torn. The system of vessels to be injected before it is possible to study the vessels of the belly, is very extensive. It includes the aortic system, or arteries of the viscera; the venous trunks of the body; the veins of the floating viscera viz. the vena portæ; besides the venæ hepaticæ; biliary ducts, &c.

INJECTION OF THE VESSELS OF THE ABDOMEN.

Injection of the arteries.—As the nearer the tube is to the parts to be minutely injected, the greater is the chance of a successful injection; the tube should, in the present instance, be inserted into the aorta immediately above the diaphragm: or the aorta being tied at this point, the injection may be made from the femoral or iliac arteries. If the injection be made from above, the thorax must be opened: in doing which, the margin of the ribs to which the diaphragm is attached should be left entire. This saves the trouble of tying the phrenic arteries, which would be cut in separating the diaphragm from the ribs. It will also be necessary upon the left side to cut the ribs nearer to the spine, that access may be had to the aorta, which lies deep in the chest. upon the left side of the spine, flat and empty, and covered by the pleura. All the vessels cut upon the edge of the abdominal integuments must also be tied, care being taken to include all the principal branches, as the epigastric artery. And if, at the same time, the thigh is not to be injected, the external iliac artery must be tied, and a cord drawn round the thigh. To inject the thigh minutely from the aorta in the thorax, requires a force that might probably burst the unsupported vessels of the intestines or stomach*. The intestines should be kept under warm water: or heated with sponges. The stomach also and bladder should be filled with warm water; and it should be remembered, that if the stomach be once distended too far, it will never be made to assume any thing of a natural appearance again. The cœliac arteries are those in which rupture is to be expected.

By this injection, all the arteries of the stomach and intestines, with the hepatic arteries, and those of the pelvis and bladder will be filled, while, at the same time, the membranes will be minutely injected.

INJECTION OF THE VEINS.—The veins also must be injected before the intestines are unnecessarily handled. There are no valves in the veins of the intestines. The liver may be injected from the ramifications of the veins in the mesentery; or the minute extremities in the intestines may be injected from the trunk of the porta. To find the porta as it enters the liver, the stomach should be held down, and the smaller omentum cleared away from betwixt the stomach and liver. The vein is then found covered in part with cellular substance, running obliquely across the spine, and parallel to the biliary duct. If uncertain of its situation, the substance of the liver may be pressed gently with the hand, or the blood urged along the veins of the intestines, when the vena portæ will rise from the confusion, a large dark blue vein.

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* By injecting from the thorax, much is sacrificed to the arteries of the viscera. When the thorax is not to be opened the injection may be made from the femoral arteries, while the aorta is tied above the cœliac; but the injection always runs better from trunk to branch than in this retrograde course.

If the veins of the intestines are to be injected, the tube may be inserted into the trunk of the vena portæ near the liver, and pointed downwards. But to inject the whole system of the vena portæ at once, a tube should be introduced into the ilio-colic vein. This branch is easily found, as it has its name from being subservient to the caput coli, and that part of the intestinum ilium which joins the colon, or the angle formed by the joining of the ilium and colon. It is only necessary, therefore, to fold back the small intestines from the right os ilium, and to expose the caput coli, and follow up the veins till they have assumed a size large enough to admit the tube. After puncturing and introducing the tube, there should also be a ligature put upon the vessel behind the tube, to prevent the injection from coming round and escaping. Before throwing in the injection, these veins should be repeatedly syringed with warm water, especially those of the liver. In throwing in the minute injection, it may be made to run more into the vessels of the intestines by pressing gently upon the trunk of the vena portæ. The vena cava abdominalis, and the veins coming into it from the liver, may easily be injected by tying the cava above the diaphragm, close to the right auricle, and injecting from the femoral or iliac veins.

DISSECTION.

The small intestines are now to be taken away, by folding the colon over the margin of the chest, and searching for the beginning of the jejunum, where the small intestine comes out from under the mesocolon, and where it is connected to the spine; then the intestine being tied here with a double ligature*, it should be cut betwixt the ligatures, and the gut should be separated from the mesentery, from this point downwards, following the convolutions of the small intestines, and leaving only a small portion of the ilion attached to the caput coli.

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* An intestine to be cut, must for cleanliness, be tied with a double ligature, so that when cut, the two ends may be

The intestines will now take a very simple form; only the colon and rectum, and the stomach, lying behind the colon, will be seen, and the duodenum coming from below it; and the course of the jejunum and ilium may be followed from the projecting portion of the duodenum along the edge of the mesentery, till the small intestines end in the caput coli. The whole of the great intestines are to be left.

DISSECTION OF THE MESENTERIC ARTERIES. Here the student must go to the Appendix, and read the branches of the abdominal aorta. The colon should be blown up, and kept forming a full arch; then the vessels of the colon and of the rectum are to be dissected, and those of the mesentery, which lie in the middle. These comprehend the distribution of the upper and lower mesenteric arteries.

The SUPERIOR MESENTERIC ARTERY supplies the small intestines, which have been cut away; and the right side of the great gut, which remains. Its trunk is found coming out from under the mesocolon and stretching over the duodenum.

The INFERIOR MESENTERIC ARTERY is much smaller in its trunk, and less extensive in its distribution. It supplies the left side of the colon and the rectum; a branch runs down over the os sacrum into the pelvis, from which the whole artery has got the name of hœmorrhoidal.—See Appendix.

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close. In the same manner, when examining the diseased inner coats of the intestines, or their contents, portions in different parts of the canal should be taken out in this way, and slit up in a flat bason; we then see the state of the contents, and the diseased state of the coats is better displayed.

The dissection is to be begun with the loose mesentery, by dissecting off the peritoneal coat and fat from the vessels. These arteries of the small intestines have no appropriated names, but compose one mass of innumerable branches, forming, before they reach the small intestines, frequent anastamoses and arches, by which the capacity of the branches combined must be wonderfully increased in proportion to that of the single trunk from which they arise.

From the UPPER MESENTERIC ARTERY, upon the right side, three branches are given off to the colon.

The ARTERIA ILIO-COLICA, whose ramifications connect the branches which go to the small intestines, and those which go to the colon. It runs down in a direction to the caput coli, and last turns of the ilium. Its branches upon the small intestines inosculate with those branches of the superior mesenteric, distributed to the small intestines in general; and, upon the great intestine, it inosculates with the second colic branch of the superior mesenteric artery; viz.

The COLICA DEXTRA which will be found running from the root of the superior mesenteric artery across towards the right side of the colon, where it begins to rise over the kidney, inosculating largely with the last branch downwards and upwards with

The COLICA MEDIA.—This branch goes directly upwards from the trunk of the upper mesenteric artery, as it comes out under the mesocolon. After running a little way upon the mesocolon, it divides; and the division going towards the right side, makes a large circle upon the mesocolon, and forms a great inosculation with the right colic artery; while the other division, going towards the left side makes such another sweep, and joins with the left colic artery, which is a branch from the lower mesenteric artery. These two branches of the median colic artery give off numerous ramifications, which supply a great extent of the middle part of the colon.

The INFERIOR MESENTERIC.—The branches of the inferior mesenteric artery are easily found.—The dissection may be made backwards, from the hœmorrhoidal artery lying upon the back part of the rectum. Proceeding up along the gut, numerous branches are found distributed to that part of the intestine which forms the sigmoid flexure. These are derived from the uppermost branch of the lower mesenteric, and as it supplies the left side of the colon, it is called the COLICA SINISTRA; it communicates with the median colic branch of the upper mesenteric artery and completes a great circle of inosculations, reaching all the length of the intestinal canal*.

OF THE ACCOMPANYING VEINS SEEN IN THIS VIEW OF THE INTESTINES.—The branches of the veins run here in company with the arteries, however different they may be in the direction of their trunks. Therefore the names and distribution of the one set of vessels being known, the other must be known also: for all vessels should be named from the parts to which they are distributed, and not from the trunks from which they are sent off; their distribution being constant, their derivation irregular.

The veins, as seen in this view of the parts, preserve a uniform course; their varieties consisting only in the direction of the trunks in which they are gathered to form the vena portæ.

Returning then upon the demonstration of the arteries — The *hæmorrhoidal vein*, rising from the back of the rectum, may be easily found, the *vena colica sinistra*, coming from the left part of the colon, the *vena colica media*, following the artery of that name, and returning the blood from the arch of the colon; the *vena colica dextra*, towards the right side of the colon, and the *vena ilio colica*, from the caput coli, then one great branch is seen promiscuously divided among the small intestines, and returning their blood to the vena portæ.

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* In the dissection of the lower mesenteric artery, its root is found entangled by the nerves of the lower mesenteric plexus, formed by branches from the sympathetic, by branches from the superior mesenteric plexus, and great cœliac plexus. The lower mesenteric plexus, surrounding the trunk of the artery, sends branches out along the mesentery to the left side of the colon, and to the rectum.

These veins are further traced in the next view of the intestines.

THIRD DISSECTION
OF THE
ABDOMINAL VISCERA.

Containing the Dissection of the Cœliac Artery, of the Trunk of the Vena Portæ of the Arteries and Veins of the Stomach, of the Liver, Gall-ducts, and Pancreas.

Separate the arch of the colon from the stomach and lay it down.

There is now much difficult dissection. The stomach will be seen lying under the projecting liver; the spleen towards the left end of the stomach: and the pancreas under it, lying directly across the aorta, reaching from the spleen to the duodenum, and involved in the root of the mesocolon.

The cœliac artery supplies all these parts lying in this upper division of the belly, above the mesocolon. It is the second artery of the abdominal aorta, coming off at the point where the great artery seems extricating itself from the diaphragm. It comes directly out from the aorta; a short trunk quickly dividing into branches.

The best way to dissect this artery, is to lay down the stomach and to dissect away the lesser omentum from betwixt the liver and stomach. The cœliac artery is then found, dividing at once into many branches; and as they depart in different directions from one point as from a centre, this is called the *axis arteriæ cœliacæ.*

The ARTERIA CORONARIA VENTRICULI will be foung going off towards the left side, and spreading largely over the upper part of the stomach. If, in dissecting it where it goes off from the trunk of the cœliac, it is found to be larger than the other branches, then it may be expected to send a branch to the liver, and should be more cautiously dissected in that direction; viz. a little to the right, and then upwards, till it be lost in the fossa ductus venosi of the liver. When there is no branch sent to the liver, it holds its course to the left or superior orifice of the stomach. Here it divides into two branches: one of which encircles the cardiac orifice, and inosculates with the gastro-epiploic artery above the spleen; the other runs down the lesser arch of the stomach, sends a branch over the broadside of the stomach, and, continuing its course, inosculates with the pylorica, or coronaria dextra. (See, in the Appendix, the table of the cœliac branch of the aorta). In tracing these branches upon the lesser curvature of the stomach, we find several nerves, they are branches of the eighth pair of nerves, or par vagum, which is the nerve of the stomach.

The ARTERIA SPLENICA arises from the trunk, or axis of the cœliac artery. It passes under the stomach, and along the borders of the pancreas, where it gives off the pancreaticæ parvulæ. Continuing its serpentine course it gives the vasa brevia to the stomach and small branches to the mesocolon. When it reaches the spleen, it makes a curve in its bosom, and enters it in several branches. It sends off from its branches in the spleen a more considerable branch to the stomach; which inosculating with the gastro-epiploic artery is called the gastro-epiploica sinistra. The artery of the spleen is tortuous; certainly not to allow the dilatation of the stomach: it is not the force of the blood in the artery which curves it, or makes it tortuous; nor does this tortuous form seem a provision for breaking the force of the blood, as the vein also is tortuous.—I have elsewhere assigned a reason for this*.

The ARTERIA HEPATICA runs in a direction opposite to the splenic artery, towards the right side. After having run some way in the direction of the trunk of the vena portæ, it divides, nearly at the same place into four branches, which spread over the trunk of the vena portæ. First, there is sent off the arteria gastro-epiploica, so named from its chief branch; or sometimes called the duodeno-gastrica, from that branch of it which goes to the duodenum. This artery descending under the pylorus to gain the great curvature of the stomach, with its accompanying vein, catches the eye while the viscera are yet entire. It is seen beautifully distributed to the stomach and omentum; and reaching the left and obtuse end of the stomach, it inosculates largely with the splenic artery. As this gastro-epiploic artery runs across the under side of the duodenum, the pancreatico-duodenalis is sent off. It runs down the intestine, and sends a considerable branch along the pancreas.

The hepatic artery after sending off this branch, almost immediately divides into the right and left hepatic branches; and from the left branch is sent off the coronaria dextra, which turning backwards, spreads its branches upon the pyloric end of the stomach, inosculating with the proper coronary of the superior orifice, and with the pyloric arteries, which are numerous and important twigs from the surrounding greater arteries. This artery sometimes comes off from the trunk of the hepatic artery (as in the plan of the cœliac). The left hepatic artery, climbing upon the vena portæ, enters the liver, and, separating into branches, continues attached to the great vein, and is distributed within the liver to the whole of the left lobe, the lobe of Spigelius, and part of the right lobe. The right hepatic branch, passing under the hepatic duct of the liver is distributed to the right lobe of the liver and the gall-bladder.

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* See Anatomy, vol. iv. p. 134, &c.

In dissecting the root of the cœliac artery and the aorta, betwixt it and the superior mesenteric artery much confusion arises, from the meshes of the cœliac plexus, and the branches coming to it from the semilunar ganglions of the splanchnic nerve, a division of the sympathetic nerve, and from the eighth pair upon the stomach. From this plexus an immense number of smaller nerves are sent out, forming lesser plexus, along the mesentery to the duodenum, liver, spleen, &c. but plans for the dissection of these nerves will be given in the succeeding part of this work.

Of the VENA PORTÆ.—The vena portæ is formed by the gathering together of the veins from the intestinal canal, and from the spleen and pancreas of the solid viscera. Near the liver these are collected from three great branches, answering to the cœliac, upper and lower mesenteric arteries. The trunk of the vena portæ lies obliquely across the spine. The branch answering to the cœliac, is the splenic vein. It forms one of the great arms of the vena portæ in the belly; it is carried in the direction of the main trunk; it gathers the blood from the spleen, stomach, pancreas, and omentum.

The veins coming up from the lower part of the belly answering to the mesenteric arteries, are the mesenterica major, and the mesenterica minor. All the veins from the mesentery, and from one half of the colon meeting together, form the first of these; which, from its size, is the most important vein of the intestines. Its branches run in company with the extremities of the superior mesenteric artery, as they are spread from the duodenum, along the track of the intestines to the middle of the colon. It joins the trunk of the vena portæ.

The vena mesenterica minor carries back the blood from the left side of the colon, and from the rectum, accompanying the lower mesenteric artery in its whole course: and from the branch which mounts up upon the back of the rectum, it has been called the hæmorrhoidea interna. This vein joins sometimes with the splenica more commonly with the mesenterica major. As the great mesenteric vein goes up under the duodenum, it receives the veins of the pyloric orifice, and those answering to the pancreatico-duodenal artery: and as the trunk of the vena portæ runs across the spine towards the liver, it receives the veins from the right side of the duodenum, and lesser arch of the stomach, answering to the lesser coronary or right coronary of the stomach, then mounting obliquely upwards and towards the right side, it enters the porta of the liver, and dividing into two great branches, forms the great sinus of the liver.

In dissecting these veins, there is much cellular substance to be cleared away; and it is not easy if the injection be at all brittle, to dissect upon their thin coats without cutting them, or breaking the injection.

As the vena portæ approaches the liver, it runs parallel to the ducts and the hepatic artery. They are here included in one sheath of cellular substance, viz. the capsule of Glisson. This was formerly thought to assist the circulation of the blood in the liver, by giving a pulsation to the vena portæ.

The vena portæ, then, is a vein performing the office of an artery in the liver, by distributing in it that blood which it collects from the arteries of the intestines. But the proper veins of the liver, the branches of the vena cava hepatica, return their blood directly to the heart. These in their extremities are distributed much like the vena portæ; but upon dissecting the under surface of the liver, they are found, when gathered into trunks, to turn away from the porta, and run up towards the attachment of the liver to the diaphragm, and enter into the inferior cava very near the heart.

The gall-bladder will be found on the under surface of the liver, half sunk into the substance of the gland; and when the liver is in its place, it is nearly horizontal. It is touched by the duodenum and colon, as their being found tinged with bile in bodies opened after death, demonstrates. The hepatic biliary duct comes from the substance of the liver; runs by the side of the great vessels; and is large compared with the cystic duct which does not come off directly from the gall-bladder but turns up a little upon its smaller end before it descends to meet the other duct, which it does at an acute angle. They run some way together before they join to form the ductus communis choledochus. This common duct, separating from the vena portæ runs down, obscured by the pancreas behind the duodenum, and betwixt the lamina of the mesocolon; then entering the coats of the duodenum, it runs some way betwixt them before it opens into the cavity of the gut *; it generally enters by the same mouth by which the duct of the pancreas enters, although sometimes they enter separately. The gall-bladder and ducts may be injected from the common duct, or by piercing the bladder; and all the ducts may be filled, by introducing the pipe into the back part of the bladder, so as not to injure the appearance of the preparation. The nerves of the liver are very minute. They come from the eighth pair, and great sympathetic: they run in two divisions, viz. with the hepatic artery before,

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* To understand the nature of the entrance of the biliary and pancreatic ducts, open the duodenum, and examine it in water.

and with the vena portæ behind. There are likewise some twigs from the anterior plexus of the stomach.

As the opening of the common duct into the intestine is apparently the easier passage, how is the bile collected in the gall-bladder? The use which is naturally suggested to us, is, to prevent the perpetual discharge of the bile into the intestine, and to reserve it to be mixed with the food as it passes the duodenum. But it is not easy to determine how this is done; whether by the distention of the intestine, and consequent pressure upon the gall-bladder; or by the contraction of the gut, and consequent opening of the mouth of the duct; or whether it be not an irritation of the mouths of the ducts themselves, by which the discharge into the intestine is regulated, and even the secretion promoted. A calculus in the common duct must, if not discharged, disorder the whole system; but the cystic duct being smaller and more valvular, concretions formed in the bladder, if they pass the cystic duct, can generally pass the common duct. When there are calculi in the hepatic duct, the ducts which ramify in the liver must be enlarged; while the ducts below must shrink, and even the bladder and cystic duct must shrink. When the cystic duct is obstructed, then the gall-bladder shrinks; and when the common duct, then it is enlarged. There are cases of calculi making their way out by the umbilicus, and leaving a little ulcer discharging a yellow lymph. This happens by the enlargement of the gall-bladder, and its adhesion to the integuments. In the *Memoires de Chirurgie,* a case is given by Petit; who was so bold as to operate upon a circumscribed tumour presenting at this place; from which he extracted a calculus, and relieved his patient from extreme agony. But for the most part, those extraordinary cases of knives cut from the stomach, and bodkins from the groin, and stones from the gall-bladder, which at first seem impossible, are but the opening of a superficial abscess, where the foreign substance having gradually made its way outwardly is almost protruding; and it is only in such a state of the parts that the operation can be performed.

There are instances of worms getting into these ducts from the intestines, and even nestling and adhering in groups.

I.

OF THE VESSELS OF THE ABDOMEN, AND THE CIRCULATION OF THE LIVER.

The vena portæ, which receives the blood from the arteries of the abdominal viscera, is like the other veins of the body, comparatively of a larger size and thinner in its coats than the arteries. It gathers its branches into one great trunk. but when it has got into the liver, though it retains the character of a vein in the thinness and inactivity of its coats, yet it assumes the office of an artery; for it again divides into branches; and its blood does not flow from its extremities towards its trunk, but, like that of an artery, from the trunk towards the extremities.

To account for this further propulsion of the blood, the muscularity of the coats of the vein, and the alternate action of the abdominal muscles, is suggested in almost every book. But the coats of a vessel, though endowed with muscular power, can give no assistance in propelling the contained fluids, unless an alternate action be allowed. Now the veins having no pulsation, their muscular fibres contract their diameter only till the force of contraction is equally opposed by the force of the circulating blood; and they then become like rigid tubes. If, therefore, the muscular fibres of the veins are proved to exist, and supposed to accelerate the blood, a pulsation must be allowed also. Ingenious men may perplex even the plainest truths; but that the veins have no pulsation cannot be long a question, when the action of the heart and vessels is attended to. The uniform flow of blood in the veins is generally accounted for, from the supposed effect of the blood in a vein receiving the impulse of the heart by channels of unequal lengths. But though this may account for it, perhaps a still more satisfactory reason may be drawn from considering the consequence of the action of the two accelerating powers, the heart and arteries. The pulsation of the heart, by a gradation of forces, which it would be tedious to explain, is continued into the extremities of the veins. This is a fact acknowledged by all who wonder how the veins, like the arteries, do not answer to the stroke of the heart. The blood is carried forward to the beginning of the veins by the contraction of the heart, at the same time that the arteries are dilating: and the arteries being dilated, they immediately contract and push their blood into the veins, which, alternating with the contraction of the heart, causes not an interrupted stream or pulsation, but a continued flow. The arteries beat because they receive a pulsation from the heart's contraction; but the veins being beyond the arteries, receive the force of contraction both of the heart and arteries; and these succeeding each other without interval, make a continued stream in the veins. To use a familiar example, they are in the situation of the nozzle of a double bellows.

If it were asked of those who say that respiration mechanically assists the circulation of the blood in the abdomen, whether these veins are more compressed during the contraction of the abdominal muscles, or during that of the diaphragm? they would hesitate; for there have been no experiments to ascertain whether the pressure upon the abdominal viscera be uniform or not. And surely, from considering the alternate action of the diaphragm and abdominal muscles, the one receding while the other acts, we must conclude that there is an uninterrupted pressure, and before it can be said that even the violent efforts of vomiting and coughing compress the abdominal veins or accelerate their blood, the state of the thorax in the same actions must be considered, and whether the pressure there be not equal to that in the abdomen. (See Observations upon the Action of the Diaphragm, Part III.)

II.

That a degree of pressure kept upon these veins by the abdominal muscles and diaphragm, is necessary, we know from an old observation of Bartholine, confirmed every day, that, upon opening the belly of a living dog, he observed the veins gradually swell, and become monstrously distended. There are frequent opportunities of observing in the human body the consequence of this tension being taken off; as in the evacuation of the waters in dropsy and in child birth, and even in the sudden discharge of wind from the intestines. In slighter cases, it is attended by a peculiar faintish feeling. Sometimes it proves fatal. In one case recorded by the younger Du Verney, the operator, mistaking for dropsy an habitual distension of the intestines with air, pushed his trochar into their cavity: the air rushed suddenly out, the abdomen became flaccid, and the patient died in a very short time. There are other cases, where the patient being wasted and feeble, a sudden discharge of wind while at stool has occasioned sudden death. But this effect is in part to be attributed to the disordered respiration proceeding from the relaxation and weakened action of the respiratory muscles.

III.

1. It strikes me, that there is in this dissection much deserving consideration, which has yet escaped the notice of pathologists. 1. The first thing which must occur to us as a great peculiarity in the liver, is the number of its vessels, and then again, this vena porta may be considered as being the very remotest part from the influence of the heart. If therefore, debility happen to be the disease of the vascular system, it is scarcely possible but that the liver must suffer in the greatest degree. Hence the frequent complaints in the liver of those whose constitutions are exhausted.

2. The liver, it must be perceived, depends for its blood in a great measure on the state of excitement of the stomach, intestines, spleen, and pancreas, and unless the arterial system of the viscera be active, there must be a slow motion of the blood in the vena portæ. 3. It is further evident that the secretion of the liver is the stimulus to the intestines. 4. As the liver, stomach, and intestines are thus mutually connected in function, so are they united by nervous connexion and sympathy. These considerations explain more of the common diseases of the abdominal viscera, than the most minute account of the *tubercles* of the liver, but to follow the subject now, would lead us from our proper object.

IV.

An inflamed liver is large, firm and of a purple colour; but the peritoneal surface of the liver is often inflamed and thickened and adhering from a cause foreign to the viscus itself. When the surface of the liver is irregular, we expect tubercles in its substance. These are most commonly the brown tubercle, as it is called, being of a yellowish white, and solid. By their growth they seem to press upon and diminish the capacity of the vessels of the viscus. The colour of the liver is as if surcharged with bile. When we consider that the hepatic extremities of the vena portæ, are thus compressed by the tubercles, we comprehend how scirrhous liver is generally attended with water in the abdominal cavity; for it is probable, that the effusion takes place from the arteries corresponding with the intestinal extremities of the vena portæ, as pressure upon the iliac vein, will produce œdema of the leg. The defective secretion of the liver is probably the cause why the gall-bladder is contracted and empty.

LAST DISSECTION

OF THE

ABDOMEN.

The cavity of the abdomen will now be freed from all the confusion of the viscera. But still a tedious dissection is required to shew the muscular and tendinous parts of the diaphragm; the passages for the vena cava, the œsophagus, and aorta; to display the muscles of the loins, the kidneys, and ureters, the vena cava, and the general distribution of the aorta.

The diaphragm is the septum which divides the thorax from the abdomen. It arises muscular from the borders of the chest, and tendinous from the vertebræ of the loins. But it has no insertion, unless the mediastinum be so considered; its action is within itself; it moves no parts as other muscles do by its contraction, it alters its own convexity, enlarges the chest and draws tight the membrane around the heart. Before opening the thorax, it may be seen how the middle part of the diaphragm is retired up into the thorax, forming a large concavity which receives much of the abdominal contents; and how it is sucked up and made tense by a vacuum in the thorax. In this state, if the thorax be opened or punctured, the diaphragm is seen to fall flaccid and loose. Observing this, the effect of the action of this muscle must be easily understood: that, by the contraction of its muscular part, the arch which it forms into the thorax approaches to a plane, and consequently enlarges the capacity of the thorax, and allows the lungs to receive the atmospheric air. The great muscle of the diaphragm, as it rises from the borders of the chest on the inside, should be first dissected. This extensive origin is to be followed round to the false ribs, and where it approaches the spine, a kind of ligament is found passing from the twelfth rib to the vertebræ, forming an arch over the upper part of the psoas magnus. This ligamentum arcuatum, it will probably be found difficult to demonstrate satisfactorily; for the fibres of the diaphragm here are strong, yet loose and flabby, and not easily dissected, as it lies under the kidney, and under much loose cellular substance, and soon becomes putrid. Down upon the spine, an irregular sheath of tendons will be found lying flat and shining, and arising from the ligaments of the lumbar vertebræ. These origins, or feet of the crura of the diaphragm, may be counted: but it is more important to observe the muscle connected with these tendons, viz. the smaller and posterior muscle of the diaphragm; and how these crura stretch over the aorta and surround it; while, by the direction of their fibres, they are prevented from compressing the great artery. These muscular fibres after passing the aorta, mingle; but they again separate to give passage to the œsophagus, and again intersect each other above the œsophagus. The central tendon is the tendon of this great circle of muscle. The fibres composing it are intricate, and form irregular interlacements, which yet keep a wonderful similarity in different subjects. Through this central tendon the vena cava pierces, to go up into the thorax. Here there are no muscular fibres, the passage being large and free.

The fleshy muscle filling up the space at the side of the spine, is the psoas magnus. It is very strong, supporting the trunk upon the lower extremity, and moving the thigh upon the pelvis. Its uppermost origin is from the last vertebræ of the back; at which place it is covered by the diaphragm: from this point downwards to the sacrum, it arises from the tranverse processes and sides of the vertebræ; which origins are concealed by its belly. It runs under Poupart's ligament out of the belly, and turns over the head of the thigh bone to be inserted into the lesser trochanter of that bone.—The tendon of the psoas parvus will be found running down on the inside of the belly of the great muscle. The iliacus internus filling up the cup of the ala ilium, may be dissected at the same time, as it accompanies the psoas, and has the same insertion.

To follow these at present to their insertion, would be encroaching too much upon the dissection of the thigh.

To dissect the great vessels of the belly when injected, is no very difficult matter; for it is but cleaning away the cellular substance from them. It may be observed how the aorta comes out under the diaphragm. It enters the abdomen upon the left side of the spine; but proceeding downwards, it shifts more towards the middle of the spine.

The vena cava in the upper part of the belly, as in the breast, does not lie close to the back-bone; but proceeds from below upwards, somewhat removed from the spine, towards the perforation of the diaphragm.

The abdominal branches of the aorta may now be enumerated. 1. The phrenic arteries, sent off as it passes under the diaphragm, or perhaps from the cœliac artery. 2. The cœliac artery sent off to the stomach, liver, and spleen. 3. The superior mesenteric artery. 4. The emulgents, one sent off on each side to the kidneys. 5. The lower mesenteric artery, &c. see Appendix.

Besides these, the aorta gives off the lumbar arteries, which are seen dipping under the psoas magnus of each side. As the emulgent arteries go off from the aorta betwixt the superior and inferior mesenteric arteries, it happens that all the great arteries of the viscera are sent out within a very small space; and at this point aneurisms of the abdominal aorta are most frequently found.

Before the emulgent artery enters the kidney, it gives off small branches to the glandula atrabilaris (which is a small triangular body, seated like a cap upon the upper end of the kidney, and which dwindles in the adult), and also to the fat surrounding the kidney. The parts surrounding the kidney likewise receive arteries from other sources, even from the phrenic arteries; and besides each of the small glands attached to the kidney has an artery peculiarly its own coming from the aorta at the root of the upper mesenteric artery. On the fore part of the aorta will be found small twigs running to supply the lumbar glands. But the arteries which there is most danger of destroying, are the spermatic arteries, which are extremely small, running down parallel to the aorta. The left spermatic artery comes more frequently from the emulgent artery than from the side of the aorta; the right more generally from the side of the aorta. The artery of each side, running down along the psoas muscle, is joined by its accompanying vein from the emulgent or renal veins: then descending it courses round the brim of the pelvis to the abdominal ring, where it meets the vas deferens as it is about to drop down into the pelvis to join the vesiculæ seminales upon the neck of the bladder.—The emulgent, and consequently the spermatic veins do not empty themselves, like the veins of the other abdominal viscera, into the vena portæ, but into the vena cava inferior; so do all the veins of the solid walls of the abdomen. The spermatic veins are the only vessels within the abdomen having valves, which is evidently a provision for their descent out of the abdomen into the scrotum.

To point out in this dissection, the nerves which must be cut; how the anterior crural nerve is composed; the connexions of the intercostal nerve; and the numerous and intricate branches going to the muscles of the loins and belly, would need a long description which would be useless since they must be more fully described in the other parts; this has been carried beyond its due length. It may, however, be remembered, that to dissect these nerves completely, so as to have a comprehensive view of them, the ribs of one side must be cut far down, the diaphragm separated from the margin of the ribs on the same side, while it is kept attached at its tendinous origins from the lumbar vertebræ, and held out so that the side of the spine may be seen in the thorax and down to the pelvis: then the kidney being lifted from its seat let it be held out, attached only by the ureters and emulgent vessels. In this situation of the parts, the sympathetic and its connexions with the spinal nerves, may be dissected in the thorax above the diaphragm: and the anterior branch or splanchnic nerve, sent off in the thorax, can be traced through the diaphragm to the ganglious about the root of the cœliac artery: and the continuation of the sympathetic nerve may be seen running near the root of the ribs. down the spine. As the sympathetic descends, it comes more towards the fore part of the bodies of the vertebræ: here it receives additions from each lumbar ganglion, and sends at the same time numerous small branches over the great vessels, and finally ends in the plexus within the pelvis.

PART II.

CONTAINING

THE DISSECTION AND MORBID ANATOMY

OF THE

BRAIN.

DISSECTION OF THE BRAIN.

When the brain is to be dissected for the demonstration of the anatomy merely, the head should be injected with fine size. The effect of this injection, is to give firmness to the brain, by which the dissection is much facilitated, and the cavities, and vessels, and plexus are more elegantly displayed. But if the brain is to be dissected, to discover the seat of disease; the head must not be injected, for by that means the colours of disease would be blended or totally destroyed.

I shall now suppose, that a young surgeon has to make a dissection of the brain, and to give a report of the diseased appearances. I shall describe the manner of dissecting the brain; the method of distinguishing the principal parts, and at the same time notice all the variety of morbid appearances which may chance to occur.

An incision is carried from ear to ear cutting through the scalp. The skin is then dissected off the cranium and drawn over the face and over the occiput. The scull-cap is then sawn in the circle, on a level with the highest part of the ear, it is burst up and separated from the dura mater, and the head is finally placed for the nice dissection of the brain. The scissars may now be run along the longitudinal sinus, and the manner of the opening of the veins into it noticed, and the *glandulæ Pacchioni* and the *trabeculæ* or little pillars like tendons. The *cordæ Willisianæ* are better seen on the inside of the dura mater.

REMARKS ON THE FIRST STAGE OF THE DISSECTION.

Very little consideration will teach us that much of the accuracy of a report on the state of the brain, depends on the attention which has been paid to the state of the circulation as indicated by the dissection.

1. Even before opening the skull, it behoves us to mark how far the vessels of the scalp are loaded with blood, and to remember, that there is often a fulness of the cellular membrane with blood and black discolouration, which is an effect of the gravitation of blood after death, and which may be on the occiput or temples according to the position of the head in death; we must distinguish this from the effect of blows or inflammation.

2. On the observation of the difference in the quantity of blood without and within the cranium, the nature of the disease, may, perhaps, rest to be explained.

3. The size and form of the cranium, may be worthy of attention especially in children.

4. The degree of resistance in raising the cranium,

may vary much, but this has relation to the age, &c. and the constitution of the bone, not to the disease of which the patient died.

5. The quantity of blood which escapes on raising the skull-cap from the dura mater: the colour and degree of fluidity is to be observed. The sinuses and the meningeal veins may be loaded with blood, so that the dura mater appears of a dark blue inclining to purple. It may be only moist with a thin watery blood; it may have the appearance of inflammation.

6. There is not necessarily a relation betwixt the inflammation of the dura and pia mater, or at least I may say, that the dura mater being properly the membrane of the bone and the pia mater, that of the brain, marks of increased activity of the circulation of the brain are apparent, when the dura mater is not affected.

OF THE DISEASES IN THE BONE AND DURA MATER.

Under this head I place such instances of derangement as are not symptomatic of the state of the brain, viz. the immediate consequences of injuries on the head; the secondary consequences; the diseases independent of injury to the cranium.

1. In injuries of the bone with fracture, there requires little aid of morbid anatomy, to inform us of what is most important. We know when a blow has been recently received by the blood in the fissure or under the bone; on the contrary, if there be inflammation on the membranes, the person must have survived the blow some time, if matter is in the fissures or on the membranes a considerable time must have elapsed.

2. When there has been a blow received, though

there be no fissure outwardly discernible on the cranium, yet we look for the breaking in of the *tabula vitrica:*

3. Although there may be no fracture, there may be extravasation of blood under the cranium, owing to the shock and consequent separation of the dura mater from the bone.

4. If a man has received a blow on the head, and after lingering has sunk, although there may be no fracture, those appearances may present,—under the tumified scalp, and betwixt the pericranium and the bone, there is exuded serum, on the inside of the skull there is pus, for the dura mater has inflamed and separated from the bone and pus is betwixt them; the dura mater is red, with enlarged vessels, the colour is bright and diffused: if the dura mater be thus affected, most assuredly the brain will have partaken of the disease.

5. A rare occurrence is a sharp spine of bone growing from the inside of the cranium, in consequence of a smart blow which has bruised the bone. I have seen such a spine as sharp as the prickle of a thorn.

6. The nature of the fungous tumours of the skull and dura mater, are not easily understood*. There are observed little bodies soft and like glands, which project from the dura mater; and these may be so large, as to have corresponding pits in the skull-cap, but they are natural. The fungous tumour of the dura mater may be thus described; there is a soft pulsating tumour under the scalp, in death it is found that the bone is deficient, and that this tumour is a fungus of the dura mater, the dura mater being examined from the inside, appears thick and very vascular, and the tumour adheres or is rather incorporated with the membrane. Sometimes the fungus has irregular pieces

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* Memoires de L'Acad. de Chirurg. tom. v. tumeurs fongueuses de la Dure-mere; see also the very interesting cases and observations, Principles of Surgery by J. Bell. vol. ii. p. 2.

of bone within its substance. Two of the first pathologists of the present age have declared such an appearance to be the result of a tumour of the dura mater, destroying the skull, and at last bursting through it. I conceive it to be a disease of the bone, (of which the dura mater is a constituent part as much as the periosteum of the common bone), and that the earth of bone being absorbed, there remains only the soft tumour of the membrane, and the vessels of the bone. It must be distinguished from *fungus cerebri.* Scrophulous tumours are said to have been found connected with the dura mater I never saw any thing like this.

7. When in venereal caries of the cranium, the bone is destroyed with a circular opening, a fungous like tumour grows into the opening, but I have found it only a thick layer of coagulable lymph on dissection. When the opening by this caries is large and irregular, I have found the dura mater cut, and a fungus cerebri the consequence.

8. Thickening of the dura mater is described, but I have not seen it independent of disease of the skull. The dura mater adheres to the surface of the brain sometimes, but this is no cause of death, nor in my mind to be counted as the cause of symptoms unless there is accompanying inflammation.

9. Bone is found in the dura mater, in the falx and tentorium. The instances on record of mania cephalalgia, syncope, vertigo and convulsions, from ossified dura mater are numerous: but as I have often found them where during life there was no symptom even of uneasiness to mark their presence, I cannot give entire belief to these relations; yet I will not deny that when these concretions press upon the surface of the brain, they may sometimes produce convulsion or insensibility.

SECOND STAGE OF DISSECTION.

I speak now of the natural anatomy. The dura mater is now cut with the scissars all around close by the bone, then it is turned up, when the falx is found to be a process of it, and to descend deep betwixt the two hemispheres of the cerebrum. 1. The nature of that adhesion which is betwixt the dura and pia mater near the longitudinal sinus is to be remarked. 2. The course of the veins of this surface of the brain and their manner of entering the sinus. 3. The delicate and transparent tunica arachnoides, is to be noticed, and the distinction of the firm opaque dura mater, the transparent and colourless arachnoid coat, and the delicate but vascular pia mater.

Now we insinuate the scissars horizontally betwixt the anterior lobes of the cerebrum, and cut the falx from the crista galli and frontal bone, we raise it out of the great fissure, and we turn the whole dura mater backward, and now see the whole upper surface of the cerebrum. 1. We see the reason of these great divisions being called hemispheres; we recollect that the lesser divisions into three lobes are to be seen only on the lower surface, and that the cerebellum and medulla oblongata are lying deep in the bottom of the cranium. 2. We separate the hemispheres, pressing them gently aside and cutting the entangling pia mater; we then see the *artery of the corpus callosum*. 3. We raise the arteries and then we discern a white body, the *corpus callosum* or *commissura magna*.

The hemispheres being replaced, the knife is carried horizontally cutting off a section from one of the hemispheres. 1. Then the distinction of cortical or cineritious and medullary matter is observed. 2. The manner in which the pia mater descends betwixt the convolutions of the brain. 3. The vascularity of the cineritious matter. 4. The open mouths of vessels and the spots of blood in the medullary substance.

DISEASED APPEARANCES ON THE SURFACE AND SUBSTANCE OF THE BRAIN IN THE SECOND STAGE OF DISSECTION.

1. The most frequent diseased appearance of these parts, is that of extravasated serum lying under the tunica arachnoides. In reading Bonet. l. 1. s. 1. de Dolore Capitis, we find many instances of serum and blood, and bile, lying on the membranes, and producing *dolor*, *gravedo* and *cephalalgia* There is no trust to be put in this. I have found it in those dying of fever, of drunkenness, of hydrophobia, of hydrocephalus, of phrenitis, of serous apoplexy, in short it is a consequence of an increased activity of vessels. 2. We have, however, to remark whether this effusion under the surface, be attended with an inflammatory state of the vessels, or if they be empty. 3. While the outward delicate and transparent membrane is entire, this fluid looks like jelly, and has been often described as coagulated lymph. But coagulable lymph accompanies a truly inflammatory state of the membrane, while this is the effect of an increased activity of vessels, the first oftener follows blows on the head, the latter will be produced by such increase of circulation, as is consequent on excessive drinking, or after taking opium, or a fever, &c.* It is to be noticed, when coagulable lymph is thrown out upon the surface,

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* We find him attributing dolor capitis to the serum extravasated on the membranes, or to the veins being loaded with black blood. The membranes of the brain, are not sensible. Such appearance denotes rather that the patient's death has been preceded by oppression of the senses.

whether or not there be a mixture of pus with it, making it of a dull or turbid colour. 4. The pia mater is the most apt to inflame of any membrane in the body on the contact of disease or from injury. We must carefully distinguish betwixt the congestion of blood in the vessels and the true effect of inflammation. The brighter red, and especially when the redness is diffused in the interstices of the vessels denotes inflammation: while the retarded circulation produces only turgidity of the vessels.

5. *Vasa cerebri flatulenta* is a title of Lieutaud, and Morgagni has much to say on the same subject; if morbid anatomy be the knowledge of the effect of disease in the body as seen after death, we have nothing to do with that title here. The air which we see lodging in the vessels of the brain is generated by chemical agency alone, after death. The moment that air, thrown into the circulation of a dog or cat reaches the brain, all animation is extinguished, we cannot therefore suppose that air exists in the vessels during the life*.

6. The convolutions of the brain are sometimes particularly distinct and hard. I have found this combined with water on the surface, and in the ventricles when the patient had been years in a state of fatuity. 7. Sometimes the substance of the brain is irregularly hard. Sometimes it is more than usually elastic. 8. I have dissected the brain, where I found that when the razor was drawn through it, it was torn up and exhibited a number of hard tubercles. The whole cerebrum was thus diseased with irregular tubercles covered with numerous vessels. The child was long stupid and lethargic. In general, in all long con-

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* In Boneti sep. we have examples of the dura mater being blown up. The observation here, will I fancy, equally apply to such appearance.—L. I. sec. I. ob. xxxi.

tinued diseases of the brain, there is water in the ventricles but I am inclined to think it a vulgar error in such cases to attribute the coma to the pressure of the water. 9. In the substance of the brain, we may find small tumours or nodules, they can be felt with the fingers; I am given to understand they are frequent in epilepsy. I have found tumours of the cineritious matter of the middle lobe, but tumours or nodules are more common in the medullary matter of the cerebrum and cerebellum. In the centre of these tumours I have found a disposition to suppuration. In this part of pathology, there is something not well understood: from the common opinion, we should be led to suppose that a tumour growing in the cavity of the cranium, must press on the brain, and produce insensibility, yet I have found the symptoms quite irregular, sometimes the patient would be for a time oppressed and revive from this state to relapse in the end into a worse degree of oppression; nay, I have found three tumours in the medullary substance of the cerebrum and cerebellum, where during the whole course of the disease, the child shewed a remarkably increased sensibility and quickness of apprehension. The sensibility and the oppression of the senses and faculties depend on the state of circulation; and disease, in the first instance, is attended by a slight increase of activity in the circulating system, which produces increase of sensibility and perception, while a greater degree of the arterial action will produce effusion of serum, and oppression. Were we at liberty here to carry the inquiry further, I am confident this opinion could be sustained.

10. *Abscess.* 1. The brain is the part of the whole body the most apt to fall into inflammation and abscess, especially when the irritation is made through the bones and membranes. 2. When for example, there is a portion of the skull dead, the dura mater separates

from it, and while pus is on the outer surface of that membrane, the inner surface adheres to the pia mater, pus is at the same time formed on the surface of the brain; an abscess eating deep into the brain is the consequence. On dissection we find a green matter on the surface of the brain, and when the substance of the brain is cut, we see that the cineritious substance has partaken of the disease more extensively than the medullary; around the abscess there are numerous spots of extravasation. 3. This spotted or mottled appearance of the substance of the brain around an abscess, I at one time attributed to the shock of the blow, the source of all the mischief in case of external injury; but having occasion to observe the same appearance in abscess where there had been no blow; I have concluded that it resulted from the force of the circulation merely. 4. When abscess is on the surface or in the substance of the brain, it is seldom that the surface of the ventricles escapes partaking of the diseased action. This, when it occurs, will of course demonstrate to us the extent of the morbid action in the brain. 5. I have found the abscess penetrate to the ventricles before the comatose state was succeeded by death. The patient with abscess in the brain has giddiness, nausea, tension, and pain, low delirium, coma or insensibility.

6. Since it is a disease of the surface of the brain, this is the place to speak of the *hernia* or *fungus cerebri.* It is a consequence of fractured skull, where the piece which is taken away in operation has pierced the dura mater, or where a portion of the skull has exfoliated, and dura mater has ulcerated from the pulsation of the brain, pressing it against the rough edge of the skull. On dissection, the tumour which had burst through the skull pressing and beating strongly, is much reduced in size, and, perhaps, wasted to a soft mass of shreds, proceeding from the substance of the brain, while there

is deep abscess in the brain. The symptoms of fungus cerebri, are the same with abscess of the brain.

7. Lieutaud speaks of gangrene of the brain, I have seen black and sooty flakes of membranes*, in preternatural cavities of the brain, yet I do not conceive that it ever happens that the death of any part of the brain precedes the actual death of the animal, nor does the term putrid apply to morbid anatomy; the secretion of abscess or ulcer, may be putrid and offensive, yet the brain itself is neither gangrenous or putrid.

8. I find a title in Lieutaud *cerebrum exsangue*. This is a very interesting subject, but to follow it with the interest it deserves, would lead us into a long disquisition. The instances which are given by Lieutaud, are all cases of syncope after repeated blood-letting; so we find too that in those who after tedious illness and great debility, faint suddenly, perhaps in rising, have the brain almost drained of blood. But in no instance is the brain so entirely free of blood as in the sanguineous apoplexy! for there, as the coagulum is formed, the vessels of the brain are compressed, so that on dissection, I have found the brain firm but bloodless.

THIRD STAGE OF DISSECTION.

I shall now suppose that the knife is carried on the level of the *corpus callosum* vertically, so as to cut down both hemispheres to the depth of the corpus callosum. 1. We see the meaning of the term *commissura magna*, for we find that the white body which we saw on looking deep betwixt the hemispheres has transverse striæ, that communicate with the central medullary portions of both hemispheres. 2. We see medullary cords running from before backward on the centre of this commissura. 3. Betwixt them is the *rapha*. 4.

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* So Boneti sep. 1, l. 1. s. 1, ob. xii.

The *centrum ovale* is the central medullary part, having the surrounding cortex or cineritious part.

When the cerebrum is cut down to the level of the corpus callosum, that part of the LATERAL VENTRICLE is opened which is above the level of the corpus striatum. The smooth handle of a knife is insinuated into the ventricle on this as on a directory we open it extensively. This first view of the lateral ventricle presents—1. The anterior horn. 2. The great cineritious coloured convexity, the *corpus striatum*. 3. Behind that the loose bloody membrane the *plexus choroides*. 4. And under the plexus, the *tenia semicircularis geminum*. 5. Following the plexus choroides forward, we are led to the *communication betwixt the ventricles*.

Both lateral ventricles being laid open, the corpus callosum is cut from its connexion with the fore part of the cerebrum, and raised. 1. As it is raised we find it connected with the fornix by the *septum lucidum*. 2. And betwixt the lamina of the septum, we see its cavity like an intermediate ventricle. 3. Having cut the septum and raised the corpus callosum, we now see the *fornix*, a triangular medullary part lying betwixt the choroid plexus.

By vertical sections, the back part of the cerebrum is to be cut down, until the *poterior horns* of the ventricles be laid open, then a probe may be introduced into the *inferior horn* which runs down into the middle lobe of the cerebrum; or the knife is placed on the corpus striatum, and a section made obliquely down towards the os petrosum which will lay open the inferior horn of the ventricle. Having opened the whole extent of the lateral ventricles, these parts will be recognized. 1. The *fornix*. 2. The space under it to which we are directed by the converging of the choroid plexus, and by which the ventricles communicate, viz *foramen commune anterius*. 3. Following the posterior limb or pillar of the fornix, we are led to the convexity called *hippocampus major*.

4. And tracing this convex floor of the posterior part of the ventricle into the posterior horn, we find what is called the *lesser hippocampus*. 5. The *tenia hippocampi* is the thin laminated edge of the hippocampus, and cornu ammonis, it is covered by the choroid plexus. 6. The *cornu ammonis* is the continuation of the hippocampus into the inferior horn of the ventricle.

APPEARANCE OF DISEASE WHICH MAY OCCUR IN THIS THIRD STAGE OF DISSECTION.

Since we have now opened the ventricles, the subject which naturally occurs the first, is *hydrocephalus*.

1. In the natural state of the brain there is no watery exudation in the ventricles. For example, within these six hours, I have dissected the brain of one who shot himself and instantly expired, the surfaces were moist, but there was no collected fluid, nor is there ever in a brain perfectly healthy, yet we very often find a little fluid in the ventricles, but we must not on that account suppose that the brain must have been compressed, and the patient's senses oppressed : we find it common in the end of most long continued diseases, or wherever there has been much excitement of the brain. 2. In the *acute hydrocephalus*, we must dissect with great caution, for while the ventricles are enlarged (I do not know that I should say distended) with water, the substance of the brain is soft, and the medullary matter will tear into shreds even by the undulation of the water. The veins on the surface are large and loaded with blood, and the veins on the inside of the lateral ventricles very large and full. The lateral ventricle is most enlarged, but yet the third and even the fourth partakes of the accumulated water.

How pathologists can suppose that the phenomena of the disease are to be accounted for by the pressure of the water, while yet the brain is more than fully supplied with blood, I am unable to conceive, but our business at present is with facts, and the description of the changes as apparent to the eye of the mere dissector*.

3. In the *chronic hydrocephalus*, the appearance presented on dissection is the most peculiar and striking. I have seen the head of a child of six years old enlarged to two feet, and a half circumference. In such a case it is found that the whole increase of size is from the accumulated water, the brain, and especially the upper part of it, being extended to a thin sac, so that the spectators are apt to suppose that there is no brain left†. I have not had an opportunity of forming a satisfactory opinion on the subject of external hydrocephalus‡.

4. The plexus choroides is naturally of a red or blood colour; sometimes it is pale from the maceration in the fluids of the ventricle, I need not say, that the state of depletion or turgescence of the vessels of the choroid coat will accord with the general state of the circulation. Sometimes the veins are unusually varicose and large.

5. But the most frequent appearance of disease in the plexus is a number of little vesicles full of fluid and attached to the membrane; I cannot agree with Dr. Baillie, in considering them to be formed by distention of the vein of the plexus; simply because they are full of a pellucid fluid, and not of blood. I have considered them as an indication of the general tendency to effusion on the membrane of the brain during some period of the disease; very generally where there is effusion under

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* See Dr. Cheyne on the Diseases of Children.

† See many cases cases collected by Lieutaud, t. II. lib. iii.

‡ There are however many cases on record.

tunica arachnoides there are these small vessels on the choroid plexus. If, for example, an old person falls down suddenly in *serous apoplexy*, there is found on dissection, a little turbid serum on the convolutions of the brain, a small quantity of fluid in the cavities of the brain, and the membrane of the plexus choroides raised into vessels*. 6. Just as the choroid plexus turns down upon the hippocampus it is very often enlarged and firm; this has been called schirrhus, but improperly. Tumours of a nature I have not ascertained are sometimes attached to this membrane.

7. *Of coagulum in the brain.* Coagulated blood from a rupture of a vessel in the brain, commonly lies near the corpus striatum, in the medullary substance of the cerebrum; sometimes the blood bursts into the ventricles. It is particularly to be observed, (for in this is the explanation of the phenomena,) that the brain is firm and adhesive, the veins on the surface flat, and there is no blood in the substance of the brain, which is therefore of an unusual yellow colour. When concussion produces extravasation, the coagula are chiefly on the surface and base of the brain. Around the large coagulum, which is poured out, the substance of the brain is mottled with little spots of extravasation; such is the appearance in sanguinious apoplexy. The principle of pathology, if I mistake not, is sufficiently plain; as the blood flows from the ruptured vessel, the vessels of the brain, not the substance of the brain, are compressed; although there be blood enough, in form of coagulum and extravasated, yet there is no blood in the vessels of the brain. Without blood, the brain cannot exercise its function, and there is total insensibility, with the accompanying symptoms of what is called compressed brain. I intend to take another opportunity

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* See for example many cases in *Lieutaud*, under the § *Hydatides*, in Plexu Choroide.

of proving this position by other facts and observations.

8. When a man dies with convulsions on one side, terminating in apoplexy and death, I have accounted for the symptoms from the tearing up of the substance of the brain, which necessarily accompanies the escape of the blood, and which will produce convulsion, but which will be followed by apoplexy, when the blood is accumlated in form of coagulum so as to compress the vessels of the brain.

9. So we find that *hemiplegia* follows apoplexy; when the general effect on the brain (the compression of the circulating vessels) is relieved, and there remains only the local injury of one side of the brain by the bursting of the vessel. The origin of nerves supplying one side of the body, is cut off from the connexion with the sensorium, and the will can no longer guide the limbs of that side, although the function of the brain be restored*.

10. I have had the fortune to see the coagulum of apoplexy in the progress of its being re-absorbed: in cutting the substance of the brain, we find it to have a yellow tinge as we approach towards the coagulum†. The next cut probably opens a cavity, having its walls of a deep yellow colour, and lying in this cavity, contracted and somewhat fibrous, is the coagulum of blood.

11. When a patient recovers from the rupture of a vessel in the substance of the brain, the coagulum is entirely taken up by absorption, but the cavity, in which it lay, remains. The sides of the cavity are

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* The injury of brain on one side produces the effect on the opposite side of the body.

† This light yellow colour of the substance of the brain is a sure indication that we are coming on some disease; it may be a tumor or preternatural cavity: if of a green colour, there will be matter when we come to the centre of the disease.

somewhat tough and smooth, and a serous fluid is in the place of the coagulum of blood. It would appear that the brain once broken down and destroyed by the extravasated blood, does not recover its structure and function; and hence, the recovery from such a stroke is for the most part imperfect.

FOURTH STAGE OF THE DISSECTION OF THE BRAIN.

1. Placing the hook under the anterior part of the *fornix*, that body is cut at its connexion with the fore part of the ventricles, and then the whole triangular portion of medullary matter forming the fornix is folded backward. In doing this we have to separate the lower surface of the fornix from a soft vascular membrane which lies under it. 2. This is the *velum vasculosum* or *interpositum*. It forms a communication betwixt the plexus choroides of either side. 3. As we raise the fornix, we see the striæ on its lower surface, which has given it the name of *lyra*. 4. We have now to observe, how the plexus of both ventricles unite forward, so as to leave a free space under the arch of the fornix, viz. *foramen commune anterius*. 5. We see the veins of the plexus running in two branches along the velum to form the *vena galeni*. By means of the hook and scissars, we have now to raise the velum vasculosum, and fold it backward also, when we discover the four great tubercles, the corpora striata, and the thalami nervorum opticorum. The *corpus striatum* is the anterior cineritious convexity, which we first discovered on opening the ventricle, but the 6th in the enumeration of parts. 7. The *thalamus nervi optici* is more behind, being that convexity of medullary matter from which we have just raised the velum vasculosum. These bodies, that is, the thalamus nervi optici of each side being convex, leave a kind of triangular opening on the fore and back part.

8. The posterior one is called *anus*, the anterior *vulva*, or as we have said, *foramen commune anterius*.

9. Now we press aside the thalami, and we discover that they are united by the *commissura mollis*.

10. We separate this connexion, and we then look down into the *third ventricle*. 11. If we put down the probe into the foramen commune anterius, we pass it from the fore part of the third ventricle into the *infundibulum*. 12. If we incline the probe backward and downward from the third ventricle, it slips into the *iter ad quartum ventriculum*. 13. Above the passage to the fourth ventricle, we see the *commissura posterior* like a nerve running across.

14. To find the *pineal gland* we must carry the velum vasculosum pretty well back, and in the very centre and behind the anus we see a small pear-shaped body of a reddish grey colour; this is the pineal gland, it is connected with the velum above, while it is attached to the side of the third ventricle, viz. the thalami nervorum opticorum by white filaments, the *pedunculi* of the pineal gland. 15. To find the anterior commissure, we look to the termination of the anterior crura of the fornix, we see it resembling the posterior commissure, but this is a true commissure, and if we make a horizontal section of the anterior part of the brain, we shall find tracts of medullary matter branching on each side, and dispersing in the medullary matter of the hemispheres. We shall again pause here, to consider the various effects which disease produces.

APPEARANCE OF DISEASE WHICH MAY PRESENT IN THIS FOURTH STAGE OF DISSECTION.

1. The velum vasculosum being connected with the choroid plexus, and being the most delicate and vascu-

lar membrane in the brain, and especially as it conveys the vessels to the central part of the brain, must never be omitted to be mentioned in the notice of the general state of the circulation.

2. I have found green pus all around the pineal gland 3. I have often found the gland degenerated into a sac of fluid, or fluid effused under its investing membrane. 4. The small particles of sand which we often find mentioned by authors as examples of disease, are now considered as natural.

5. The third ventricle suffers much less distention in hydrocephalus, than the lateral ventricles, more than the fourth ventricle.

6. We may now lift the anterior lobes of the brain, and look down on the first and second pair of nerves, and the carotid artery. 7. In examining the nerves we have to understand that as a muscle having been in full action, is seen upon dissection to be red and full of blood; so, on the other hand, a nerve being in its perfect state, is white and opaque; and as the muscle of one who has been paralytic, and consequently inactive, or of one who has long suffered the debility of disease and confinement is pale and loose, so a nerve which has not been exercised is pale and transparent. This explains the nature of the examples which are given of the *marcor nervorum*. 8. In case of *amaurosis*, we may expect to find the nerve of the affected eye smaller, paler, and more transparent, and notwithstanding this change on the nerve, we are not allowed to conclude that this is the cause of the blindness, for it may be the effect, since I have found it in one who had lost the sight of the eye by an accident; this state of the corresponding optic nerve being evidently the consequence of the sensation being no longer transmitted; the cessation of its function.

9. Wherever there has been affection of the eyes, it is our business to turn back the anterior lobes of the cerebrum, and to observe if there be any coagulum or

tumour pressing upon the course of the nerve, or of the *tractus opticus*; or if there be a disease in the thalamus nervi optici; or if the carotid artery be enlarged and press on the nerve.

10. In old age we very often find the *carotid arteries* as they rise by the side of *sella turcica,* hard with ossification. I have seen them enlarged to three times their natural size, but never forming a proper aneurism. Though this does occur; 11. I do not recollect to have seen the pituitary gland diseased. 12. When disease spreads from the bones and membranes of the nose to the brain, it is by the destruction of the œthmoid plate, in consequence of the pressure of a tumour, or the assimilation of the bone into the diseased action, then come all the symptoms, and the kind of death which we see in the ulcer or vomica cerebri; matter and ulceration is upon the lower surface of the lobes.

TO PROCEED WITH THE DISSECTION.

1. We replace the anterior lobes of the cerebrum and then cut away the *tentorium,* that process of the dura mater which covers the cerebellum. In doing this we will perceive the termination of the longitudinal sinus in the lateral sinuses, and the termination of the vena Galeni in the fourth sinus. The fourth sinus is that which lies in the angle between the falx and tentorium; it terminates in the union of the first, or longitudinal, and the second and third, being the lateral sinuses. The fifth sinus is that vein which is in the lower edge of the falx; it joins the fourth sinus.

2. When the tentorium is raised we have a full view of the *cerebellum.*—The cerebellum is subject to all the varieties of disease which we have described in the cerebrum. From its situation it is sometimes diseased when the cerebrum is not affected. I have

found the most decided marks of increased action in the whole vessels of the cerebellum, while the cerebrum was quite natural. I have dissected three cases, in which the caries of the temporal bone has communicated disease to the cerebellum, and occasioned death. First, there is long continued suppuration in the ear—the bones of the tympanum are discharged—there is occasional great pain, headach, and oppression; the oppression becomes continual, and the character of disease is like hydrocephalus, and the person becomes paralytic of one side, and dies. On dissection, the pus is confined under the tentorium, and there is no appearance of disease till the tentorium is torn up, when a quantity of purulent matter bursts out, and the cerebellum is green, with ulceration on its surface, or abscess is within its substance. When the cerebellum is taken out the dura mater covering the os petrosum is diseased, and the bone itself is black. 3. When pathologists imagined that pus found on the surface of the brain was extravasated blood, degenerated and putrid, they imagined also that when a tumour arose, with a softening of the bone behind the ear, and a vomica cerebri, that it proceeded from the stagnation of the blood in the lateral sinus. It is the disease which I have now described, for sometimes in suppuration of the cavities of the ear, the cells of the mastoid process of the temporal bone become finally the seat of the disease, and then the ulceration destroys the outer shell of bone, and at the same time infects the membranes and substance of the cerebellum by its progress inward.

4. If we are dissecting only to discover if there be disease in the fourth ventricle, we may cut out a triangular portion of the cerebellum, which will enable us to look down into that cavity. But if we wish to examine it more carefully we must turn back the whole brain, cut across the spinal marrow, and take all out from the skull, then dividing the cerebellum

with a perpendicular incision, the lobes are separated so as to exhibit the fourth ventricle, the *valvula Vieussenii* and *calamus scriptorius*. 5. When we have dissected the brain, if there be fluid blood or serum at all, much will fall down to the base of the skull. I have seen this noted, as blood and serum on the base of the brain, and a learned doctor gives his disquisition on the principle of pathology, deducing a train of symptoms from compression of the origin of the nerves, &c.

MALCONFORMATION OF THE BRAIN.

The *acephalus* presents the monstrous appearance of a face, fixt as it were on the top of the thorax, without a cranium. Generally we find a little bulb at the top of the spinal marrow and an intricate texture of nerves in the base of the skull, but no encephalon.—Sometimes the cerebellum is found, but no cerebrum. Sometimes the spinal marrow, as well as the brain, is deficient.——From the scalp in these cases of malconformation, there is commonly either a soft sac which hangs backwards, or a soft spongy tumour cellular and full of fluid.

A SYSTEM

OF

DISSECTIONS.

DISSECTIONS

OF THE

THORAX.

THE present subject shall be divided in such a way, that each branch of it may be comprehended in one dissection, or view of the parts, as they lie in the dead body: and those parts of the anatomy shall be chiefly dwelt upon which are useful in dissection, or in understanding the local or organic diseases. The two first dissections of the thorax naturally include the muscles and blood-vessels which lie upon the breast and lower part of the neck; then, proceeding to the viscera, the appearance of the heart, lungs, and mediastinum, upon lifting the sternum, makes the second division; next the manner of displaying the heart is to be explained; afterwards the injection of the heart, with the dissection of the great vessels proceeding from it. Lastly, the morbid anatomy of the breast will solicit attention: first, aneurisms, and the diseases of the heart and larger vessels, with the circumstances which are to be observed in the dissection of those diseases; and, secondly, the diseased appearances of the lungs, of the pleura, and of the cavity of the chest in general.

It may, however, be proper further to observe in this place, that in explaining the situation of the heart and great vessels, and the play of the lungs, it is impossible to overlook the deficiencies in the accounts that are given of the mechanical action of the heart and vascular system, and of the effect of respiration upon the action of the heart, or rather of the manner in which its effect upon the heart and veins is counteracted. And it surely will not be thought too great a departure from the plan and limits of this book, to touch slightly upon these important points.

FIRST DISSECTION

OF THE

THORAX.

The Dissection of the Muscles and Blood-vessels which lie upon the outside of the Chest, and lower part of the Neck.

Nothing confounds a person more in dissection than an ignorance of the parts which immediately surround that upon which he is employed: therefore, in explaining the dissections of the outside of the chest, it is proper to point out, not only the muscles, and the branches of the arteries which lie upon the chest, but those likewise which lie in the axilla, and upon the neck, as being strictly connected with them in every useful inference to be drawn from the anatomy of the part.

FIRST DISSECTION.

Make an incision from the thyroid cartilage down the middle of the sternum, and extending below the scrobiculus cordis; then make an incision in the direction of the clavicle, and over the top of the left shoulder. In dissecting the integuments of the breast, carry the knife in the direction of the last incision; by which the pectoralis major muscle and the deltoid muscle will be smoothly dissected in the direction of their fibres.

No fascia will be found expanded over the muscles which lie upon the chest; but the fibres of the muscles are separated from the fat lying under the skin by a thin aponeurosis of an opaque and milky whiteness, which adheres closely to them, and is not easily dissected away, unless very regularly done, as the dissection of every muscular part ought to be. The PECTORALIS MAJOR arises from the fore part of the clavicle from the sternum and from the cartilaginous endings of the fifth and sixth ribs. From the origins of such extensive flat muscles as this, the fibres are generally prolonged into fasciæ, scarcely distinguishable from the common membrane. Of this kind are the fibres which stretch across the sternum from one pectoral muscle to the other, and are connected with the periosteum. So considerable is the membrane resulting from the extended margins of the PECTORAL MUSCLE, the SERRATUS ANTICUS, the RECTUS, and OBLIQUUS ABDOMINIS, that they may all be lifted at once from the ribs, and yet be preserved attached to each other. A slip, taking its origin from the sixth rib, goes up to the pectoral muscle. The fibres of the pectoral muscle are seen converging to form the tendon, by which, turning round into the axilla, it is inserted into the arm-bone. It will be observed, that the upper portion of the muscle, arising from the clavicle, descends, in a direct line, to its insertion; while that portion of the muscle which comes from the lower part of the breast twists as it goes round into the axilla, and is inserted into the arm-bone, nearer its head than the part of the tendon answering to the upper margin of the muscle.

The origins of the external muscle of the abdomen and the serratus magnus form part of this dissection. Then the pectoralis major is raised, and the pectoralis minor and subclavius are to be dissected. See the Appendix under the division of the muscles of the chest.

OF THE

BLOOD-VESSELS CONNECTED WITH THE DISSECTION OF THESE MUSCLES.

Betwixt the deltoid and pectoral muscles there is found cellular membrane and fat; and from the upper part of this interstice, and near the clavicle, a considerable branch of an artery comes up from the subclavian artery, and is distributed over the shoulder and upper part of the pectoral muscle. This is the RAMUS SUPERFICIALIS ARTERIÆ THORACICÆ ACROMIALIS of Haller, or a branch of the third thoracic artery. See Appendix, Axillary Artery III. If this branch be dissected towards its origin (by separating the pectoral and deltoid muscles), its branches under the pectoral muscle will be seen, and also the trunk of the subclavian vein originating from the basilic and cephalic veins; and behind it the subclavian, or rather, as it proceeds downwards, the axillary artery. It is here, in the angle of the joining of the clavicle with the acromion process (which projects upon the top of the shoulder and over the head of the arm-bone,) that the attempt to compress the axillary artery is to be made in operations upon the joint, &c.; the attempt is sometimes made above the clavicle, and at the outer edge of the origin of the mastoid muscle from the clavicle.

Upon the fore part of the pectoral muscle, again, several small twigs of arteries will be found coming up through the interstices of the ribs. See Appendix, Fifth Branch of the Mammaria Interna. These, when minutely injected, are seen inosculating freely with each other, and with the twigs sent from the axillary and subclavian arteries. The arteries coming round from the axilla by the lower edge of the pectoral muscle are the extremities of the long thoracic artery (a branch of the axillary artery,) which is also called the pectoral or external mammary artery. The mammary arteries I have found entirely ossified, and rigid in old women.

All these arteries (and chiefly the last mentioned branch) throw out their blood in the extirpation of the mamma. The intricate situation of the axillary glands should be observed, that it may be understood how far these glands, being enlarged and diseased, may encroach upon the trunk of the axillary artery.

In dissecting above the clavicle, and in carrying back the flap of skin from the side of the neck, in the angle betwixt the sterno-cleido-mastoideus muscle and the trapezius, the fat will be found in most subjects loose and watery, and of a granulated appearance, especially in young subjects. This confused fatty mass must not be taken away rudely, for under it lie many important parts*. The EXTERNAL JUGULAR VEIN will be found close by the outer edge of the mastoid muscle, and passing under the clavicle at the angle formed with it by the origin of the mastoid muscle, to join the subclavian vein, a considerable artery (the TRANSVERSALIS COLLI, the 2d branch of the lower thyroid) will be observed, sending its branches all over the side of the neck, and round under the trapezius muscle. Betwixt this artery and the root of the external jugular vein, the OMO-HYOIDEUS MUSCLE, a long and flat muscle, will be seen passing obliquely upwards to the os hyoides; and as it goes under the mastoid muscle, it may be seen degenerating into a middle tendinous part. Under this muscle again, and from betwixt the origins of the scaleni muscles, the cervical nerves are seen descending to form the axillary plexus. The small lymphatic glands, the GLANDULÆ CONCATENATÆ, may be observed lying upon the side of the neck. And further, it may be observed, that the nerve which passes backwards through the mastoid muscle, and which lies close to the muscle and under the branches of the external jugular vein, is the NERVUS ACCESSORIUS, which comes out from the skull in union with the eighth pair. Lower down, behind the mastoid muscle, and lying upon the scaleni muscles, there is found a most important nerve, derived from the cervical nerves; this is the phrenic or diaphragmatic nerve, which should be carefully preserved for the demonstration of the nerves of the thorax.

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* These parts are more fully described in a future division of the work.

It will be immediately understood how this part of the root of the neck, and just over the clavicle, forms the must deadly aim of the assassin; for his knife passes at once into the breast, and pierces the great vessels near the heart.

More towards the fore part of the neck we may observe the following parts. Upon lifting the mastoid muscle a little from its seat, and holding it aside, the continuation of the omo-hyoideus muscle is seen passing upwards, and spreading into a second belly. Under this the CAROTID ARTERY and JUGULAR VEIN are found lying in their sheath; and betwixt them the PAR VAGUM, or eighth pair of nerves. A little more towards the fore part of the trachea and superficially a small nerve is found coming down from the root of the tongue, and from under the angle of the jaw, viz. the DESCENDENS NONI.

Upon lifting back the mastoid muscle, the flat ribbon-like muscles of the throat are found so accurately laid upon each other, and embraced and connected by the cellular substance, that the individual muscles are scarcely to be distinguished before dissection. The thyroid veins, lying upon the fore part of the throat, should be preserved; they run down in a direct course from the thyroid gland to the trunk of the left subclavian vein as it crosses the top of the chest.

OF THE MAMMA.

The mamma in the female subject should be attended to. It is seated on the great pectoral muscle. Its bulk is greatly made up of the fat which surrounds the proper gland. The central glandular part is a congeries of lesser glands connected by their ducts and vessels, and invested in a cellular membrane. It has its arteries, 1st, from the internal mammary artery, the branches of which, spreading betwixt the pleura, pass from betwixt the ribs, and through the pectoral muscles, into its substance. 2d, From the external mammary or thoracic arteries, branches of the subclavian artery. 3dly, From the intercostal arteries. These become more important branches, from their increased size, when the gland is diseased, hardened, and enlarged. They all form anastomosis with each other. The external mammary artery also forms a very remarkable inosculation with the epigastric, by which Boerhaave and Whyte explained the sympathy of the womb and breast, a connexion which depends upon other laws of the economy. The veins are very numerous, and pass superficially under the skin. In women giving suck, they become enlarged, and very evident.

The lobulated structure of the gland has much of the cellular membrane interposed; and this adipose membrane both invests the gland on the outside, and also connects it with the pectoralis major. The lymphatics run chiefly towards the axilla, and pass through the axillary lymphatic glands, some go towards the sternum and clavicle.

We have to observe, the elastic structure of the NIPPLE, OR PAPILLA. The glandular structure of the skin around the nipple. The opening of the LACTIFEROUS DUCTS. When distended, the ducts take an irregular varicose-like form. This structure is useful, as the milk being continually secreted into these ducts, is collected until it distends the more varicose and dilated parts. The ducts are contracted before they terminate on the nipple, and the structure of their orifices is such, as only to allow the milk to pass when the nipple is drawn out by the sucking of the child. The areola, or dark-coloured zone surrounding the nipple, is of a paler colour in girls; it changes to a darker colour during menstruation, in women with child, or when giving suck. The glandular structure of the areola and nipple is to prevent excoriation. But like all glandular parts it is subject to disease.

SECOND DISSECTION OF THE THORAX.

Being the Continuation of the Dissection of the Blood-Vessels and Muscles.

When the chest is freed of its muscles, we see the conical shape of the whole thorax; each rib, as it is removed from the first, being the segment of a larger circle. We observe the extreme narrowness of the chest above, and that it is by the projection of the bones and muscles of the shoulder that the appearance of breadth is given to the chest. So wounds passing aslant the ribs, and through the pectoral muscles and the shoulder, or into the axilla, shall appear to have penetrated the ribs; the probe, while passing under the scapula or pectorál muscles, may seem to be penetrating the chest.

The dissector now examines the connexion of the clavicle with the sternum, and thinks of the dislocation of that bone. He examines the cartilaginous connexion betwixt the sternum and ribs. He is aware of the spongy texture of the sternum, and effect of fracture or caries of it. He ought to dilate the lungs, and examine the motion of the bones of the chest, and consider the necessary consequence of this motion on the ribs and sternum, in case of fracture.

THIRD DISSECTION OF THE THORAX.

Of Opening the Thorax,—and of the Connexions of the Heart, Lungs, and Investing Membranes.

To open the chest, the integuments are to be cut through in the length of the sternum, and with the origin of the pectoral muscle are to be dissected back, until the joining of the cartilaginous and osseous part of the ribs is laid bare; which is observable by the difference of colour, the whiteness of the cartilage, and the livid or cineritious colour of the bony part of the rib. At this joining, the ribs, and the intercostal muscles, are to be cut through; and the joint of the sternum with the clavicle, being dislocated, and the lower part of the sternum separated from the diaphragm, it is to be lifted upwards, or entirely removed. But if we proceed thus where there is to be afterwards an injection of the vessels in the breast, there will be a great destruction of small branches of arteries, and much trouble in tying the internal mammary and intercostal arteries: in this case, therefore, it is better to saw through the sternum at once, after the first incision, and violently to draw 'the divided sternum asunder; for by this the internal mammary arteries are preserved, a great ornament to a preparation of the chest, and no arteries of importance are cut. In private dissection, when the abdomen is to be opened, the incision may be continued down from the sternum to the pubis: for the integuments in all this length, from the clavicle to the pubis, will stretch sufficiently to lay open the viscera of the belly in this one longitudinal cut.

When the sternum is lifted, the anterior mediastinum is stretched betwixt the pericardium which covers the heart, and the under surface of the sternum; and it must be cut before the sternum can be fully raised. On looking under the sternum, when raising it, the mediastinum may be seen stretched, and (as it is gradually torn from the lower surface of the sternum) separating into two layers, and forming a triangular cavity. This is more evident in young subjects. This cavity, when the sternum is let down again, is seen to close by the elasticity of the membrane. In children, the mediastinum, and all the membranes lining the chest, are more delicate and transparent; and when the sternum is thus raised, in this cavity, which is artificially produced betwixt the layers of the mediastinum, the lowermost part of the thymus is seen. With little dissection this gland may be displayed, its root connected with the lower thyroid veins, and its lobes lying on the pericardium; its vessels are from the internal mammary vessels; its function is altogether unknown; it shrinks and disappears in the adult.

When the sternum is laid back, the parts appear thus: The thorax is divided into two distinct cavities by the mediastinum, the lungs of each side are lying distinct from each other in these cavities, and betwixt them the heart, obscured by the pericardium; and the cellular membrane, which, before the sternum was raised, formed the anterior mediastinum, is scarcely to be distinguished upon the pericardium. The mediastinum dividing the thorax, will in the subject be observed to run obliquely; for on the lower part of the sternum, and near the diaphragm, it does not adhere to the middle of the sternum, but is removed towards the left side, and is attached rather to the cartilaginous parts of the ribs than to the sternum. This makes the right cavity of the chest larger than the other; and the difference is further increased by the heart included in the pericardium and protruding from the mediastinum, still further into the left side.

The PLEURA is the membrane which lines both cavities of the chest; and as these cavities do not communicate, the pleura of each side is a distinct sac; and, by their coalescing in the middle these sacs form the mediastinum. This division of the thorax by the mediastinum keeps the lungs of one side independent of those of the other, and the action of the respiratory muscles will dilate the lungs of one side, although the cavity of the other side be laid open, and the lungs of that side have fallen collapsed and inactive. The inner surface of the pleura, where it lines the ribs, is dense and smooth; but on the side attached to the ribs it gradually degenerates into the common cellular texture. Therefore, to divide the pleura into layers is not difficult: but still the one layer will appear the common cellular substance, or the periosteum of the ribs; while the other will be the smooth internal surface of the pleura.

If there be no preternatural adhesions of the lungs to the pleura where it lines the ribs, the general figure of the lungs is easily understood. It will be seen, that the base of the lungs, or that part which rests upon the diaphragm, is concave, answering to the convexity of the diaphragm; that they reach far behind the diaphragm; and that they are pyramidal towards the upper part of the chest, answering to the pyramidal shape of the Thorax.

The lungs of each side are subdivided into lobes. Those of the right side generally into three, two greater ones, and an intermediate lesser lobe; and the left into two lobes. This, however, is sometimes reversed. These lobes are again divided into groups of cells; and these again into a series of smaller vesicles, into which the air is admitted by the minute and less rigid branches of the bronchiæ. Into the sulci, forming the divisions of the lungs into lobes, the delicate membrane investing the lungs is continued. These clefts in the lungs cannot surely be for allowing them easy motion, in adapting themselves to the form of the chest, or in embracing the heart with their prolonged points: for as there is no cavity in the chest before it is opened, and as the surface of the lungs is closely applied to the surrounding surfaces there can be no room for motion in the sides of these clefts upon each other. On the contrary, they must keep as closely in contact as if they adhered: nor can one lobe retract whilst another swells up to fill its place, as in the intestines, the motion of the lungs not being caused by their own powers of contraction or dilatation, but by that mechanism which surrounds them, and which must apply equally to all the lobes at once. It is evident, that the pleura has the same relation to the lungs, and inner surface of the chest, that the peritoneum has to the intestines and inner surface of the abdominal muscles. The pleura costalis is that part of the membrane which lines the ribs; the pleura pulmonalis that part which covers the lungs; at the root of the lungs they are continuous.

That the relative situation of all the parts, and the inflections of the pleura, may be correctly understood, they may be illustrated thus: In the middle of the breast lies the heart, with the great arteries and veins proceeding from it, and the trachea and œsophagus. These all lying betwixt the sternum and spine, would form a division of the breast independently of the mediastinum. The lungs, again, lie upon each side, connected by their arteries and veins, and the branches of the trachea. Now, suppose two bladders, one on each side of the thorax, placed betwixt the lobes of the lungs and the ribs; suppose also that these were to swell till their sides insinuated into every interstice, and covered every projection; the sides of these cysts, having stretched over the surface of the lungs, would, if allowed to meet in the middle of the breast, form a partition, consisting of two layers of membranes. But where the heart and great vessels intervene, the cysts would not coalesce, but would contain these parts betwixt them. Near the fore part, under the sternum, and before the heart, they would meet: and behind, again, near the spine, they would contain, betwixt their layers, the great vessels running down the fore part of the vertebra; and as they came off from the spine over these vessels, they would form a triangular space, surrounding the œsophagus, aorta, vena sine pari, and thoracic duct. Such, indeed, is the manner in which the anterior and posterior mediastinum are formed by the two layers of the pleura. Only it will be observed, that in nature there is no actual coalescence of the pleura of each side to form the mediastinum, as the intervening heart and vessels leave no interstice for this union; unless the anterior mediastinum shall be considered in this light. But, to proceed with the illustration, supposing these bladders to be insinuated betwixt the lungs, they would be stopped by the vessels which go to the lungs from the heart; and surrounding them, they would form the LIGAMENTA PULMONUM. To carry the similitude a little farther for the sake of illustration, let us suppose that the outer surface of these sacs were to adhere, at one part, to the inside of the ribs, and, following the curve of the inside of the chest, to adhere also to the vessels going to the lungs, and to the lungs themselves, a lively idea of the real situation of the pleura may be obtained. For this membrane may actually be traced from the inside of the ribs over the vertebræ of the back, and from the vertebræ over the lungs, and then reflected from the root of the lungs to the mediastinum.

When the breast is opened, the lungs collapse, since they are kept distended only by that complete vacuum which is in the thorax. By collapsing, they lose their natural situation, and retire from the side of the pericardium. The heart, covered with its pericardium, is seen protruding its apex towards the left side, and pushing the mediastinum, which covers the pericardium, before it. It is seated upon the diaphragm, to which the lower surface of the pericardium adheres, while the layer of the mediastinum is reflected off upon the diaphragm; and this layer can be dissected from the pericardium in the young subject.

In this first view, the phrenic nerve will be seen descending to the diaphragm upon the side of the pericardium, and turning over the apex of the heart. The vessels which are seen upon the fore part of the pericardium belong to the pericardiac branch of the internal mammary artery; and the larger branch which is seen accompanying the phrenic nerve is the ramus comes nervi diaphragmatici of the same mammary artery anastomosing with a branch of the right phrenic artery.

OF THE EFFECTS OF DISEASE ON THESE PARTS.

Pleura.—The investing membrane of the thorax has the same structure with the peritoneum. It is a simple membrane, with many vessels ramifying in it. These, in their natural state, secrete a halitus, or rather they unremittingly perspire a fluid, which moistens the surface, and prevents the lungs from adhering to the pleura costalis.

Hydrothorax is a collection of water in the cavities of the chest; the secretion is poured out in too great a quantity. It is seldom a disease confined to the pleura, but is rather a symptom of universal debility, and is often accompanied with anasarca. In young subjects, dropsy of the chest follows some acute disease, as the measles, and then I have found in children a most enormous accumulation in the thorax and in the pericardium.

The pleura is much subject to INFLAMMATION. It is seen thickened and crowded with vessels; a coagulable lymph is generally thrown out on its surface, and white serum is floating in the cavity of the chest.

The coagulable lymph or inflammatory crust can be felt upon the inner surface of the chest, and torn from them with the fingers, a tremulous gelatinous layer; or upon the surface of the lungs a jelly is thrown out, which can be wiped away with a cloth. These exudations approach in their more advanced stages to the appearance of the natural membranes, and can with difficulty be distinguished from the original membranes. Any vacancy found in the thorax from disease, as from the destruction of the lungs of one side, and the formation of pus is generally accompanied with these layers of coagulable lymph upon the inner surface of the ribs, and with inflammation and thickening of the pleura; or we find a serous fluid in the bottom of the chest, with flakes of the coalgulable lymph, like membranes, floating in it.

OF ADHESIONS OF THE LUNGS.—Adhesions of the lungs to the pleura, where it lines the ribs, or where it covers the pericardium, are so frequent, that they need scarcely be considered as a disease, at least they are of no account in investigating the cause of death; for it would appear that the slightest inflammations during any period of the person's life, even from colds which pass unobserved, produce adhesions which are never afterwards removed.

To account for the more frequent occurrence of inflammation and adhesions in the membranes of the breast, there have been several hypotheses suggested; and particularly it has been said, that the vessels which supply these interior membranes are branches of arteries common to the pleura and integuments of the breast: and that the outer branches being more liable to occasional derangement in their action, an accumulation is brought upon the inner branches. But the distribution of the mammary and intercostal arteries, when compared with the epigastric in the abdomen, or with the distribution of vessels to any other internal membrane, does not support such a conjecture; for they also have external branches; and if there be found a greater frequency of inflammation in the thorax, it may rather be imputed to the peculiarity of the function of the lungs in inhaling the air, and being consequently more liable to suffer from the vicissitudes of the weather.

When the lungs become diseased, and abscesses are formed in their substance, the inflammation extending round them, and communicating through the pleura pulmonalis or external coat of the lungs, forms adhesions betwixt the lungs and ribs or pleura costalis. By this means the matter of the abscess, when it has made its way out of the lungs, is still held confined in a sac, and prevented from spreading freely into the whole cavity of that side of the chest. From this pervading of the inflammation previous to the bursting of an abscess in the lungs, we may have the following appearances upon opening the chest: the lungs are compressed, hard, and apparently incapable of their function; coagulable lymph is exuded upon the surface of the pleura; partitions are formed extending from the inner surface of the ribs to the collapsed and hardened lungs: sinuses of matter are seen running among these irregular adhesions, and the lungs themselves, if far advanced in the disease, are full of pus in many places, which escapes upon their outer membrane being torn open.

OF EMPYEMA.—This is matter lodged betwixt the lungs and pleura. The abscess or vomica in the lungs, and the matter in the pericardium or mediastinum, is not empyema, until they have burst and diffused the matter in the cavity of the breast.

Collections of matter may be formed in the cavities of the chest independent of the lungs, from the inflammation of the pleura advancing to suppuration; and collections of matter, or serum, have been found betwixt the pleura costalis and the ribs, which have pushed the pleura in upon the lungs, and compressed them; this must be very rare. It would seem to be a general opinion, that matter formed in the membranes, independently of the lungs, has a greater tendency to open outwardly by the intercostal spaces, than that matter which, though lodged in the cavity of the chest, was originally derived from the lungs. In fact, the true empyema is often occasioned by injuries from falls or violent exercise, as wrestling, followed by deep pain in the breast. It is not by the pressure of the lungs in expanding, as it has been somewhere written, that the matter of empyema has sometimes been spontaneously evacuated by the side, but by the communication of inflammation and ulceration; and the old practice of burning the side, or making an incision until the pleura was bare, had the effect of procuring a tendency to this spontaneous evacuation.

OF THE LUNGS IN A STATE OF DISEASE.—1. In cutting into the substance of the lungs of consumptive people, the most frequent appearance is groups of little white or variegated tubercles. Tubercles are not now considered as diseased glands. I have seen them on the peritoneum and pleura, where there are no glands. These tubercles, in a more advanced stage of the disease, make the surface of the lungs hard and irregular; and when the lungs are cut into, they are found to have increased in size, and to have run together into masses, and commonly little abscesses or VOMICÆ have formed in them;—or, the tubercles being distinct, they are found to contain a white thick pus. In their still further advancement, they have wasted under the suppurative action, and now the pus is contained in irregular sinuses; and the whole lungs gradually approach to that state which has already been slightly described, viz. they contain small purulent abscesses, or large vomicæ, and are stuffed with innumerable irregular tumours—some dormant, others inflamed and suppurated. The term vomica, should be confined to the collection of matter in the lungs perhaps, but saculated collections of matter in the pleura, or intercostal spaces, are also termed vomicæ by authors. These scrophulous tubercles, more or less affect the surrounding substance of the lungs, according to the activity of the accompanying inflammation. Sometimes the tubercles and abscesses affect the surrounding substance very little; but often the surrounding substance of the lungs is dense by inflammation.

2. I have found tumours projecting from the surface of the lungs, and interspersed widely in their substance, of quite a different texture from these tubercles, being of a very vascular and porous, or cellular nature, I might call them, perhaps, bloody tumours. Those upon the surface are of a reddish colour, and covered with a smooth membrane. They have no tendency to suppuration. I have found them in a subject, where there was a similar diseased structure in the liver, and lymphatic glands, and in the substance of the testicle. Indeed when the lungs are diseased, we generally find that the lymphatic glands are also diseased and especially the mesenteric glands. Dr. Baillie describes a soft, pulpy tubercle, of a light brown colour, of course differing from either of these.

INFLAMMATION OF THE LUNGS.—3. Dr. Baillie observes, that the portion of the lungs which is inflamed becomes considerably heavier than in the natural state, from the accumulation of blood in its vessels, and the extravasation of the coagulable lymph; it therefore commonly sinks in water. It feels like a solid substance when pressed by the fingers, and there is no crackling of air, as in the healthy structure. This, however, will be more or less marked, according to the degree of inflammation.

This inflamed state of the lungs is to be distinguished from blood accumulated in some part of them after death in consequence of gravitation. From the body lying in the horizontal posture after death, blood is often accumulated at the posterior part of the lungs, giving them there a deeper colour and rendering them heavier. In this case there will be found no crowd of fine vessels filled with blood, nor any other mark of inflammation of the pleura. Where blood too is accumulated in any part of a lung after death from gravitation, it is always of a dark colour; but where blood is accumulated from inflammation, the inflamed part will appear in a great measure florid. Some epidemics are peculiar in as much as the action of the vascular system of the lungs tends to sudden congestion and infarction, in which case the expression has been, Pulmo gravis, atro cruore infarctus et in aqua subsidens.

4. But this is not all that is important in the inflammation of the lungs. The state of the trachea, the bronchiæ, the cells of the lungs, and the common cellular texture of the lungs must be considered.—In the pneumonia of children, as I have found in several instances of dissections I made for Dr. Cheyne, of Leith, the lungs did not collapse on opening the chest, yet there was no appearance of inflammation in their surface, but in the bronchiæ there was inflammation and much mucus, with a mixture of purulent matter; this it was which prevented the free escape of the air from the cells and the collapse of the lungs. The same appearance is found in the bronchiæ of

adults*. I have found the inflammatory membrane of croup extending to the utmost branches of the bronchiæ, and there softened by an admixture of purulency with the coagulable lymph. The coagulable lymph thrown out from the mucous membrane of the larger branches of the trachea in adults I have found to be almost of a cartilaginous firmness. 5. The *pulmonum emphysema* deserves attention. It is that case where the air has escaped from the proper air-cells into the cellular membrane. 6. I think too I have observed the extravasation of serum into the interstitial cellular membrane to be very deadly. 7. The proper air-cells of the lungs are sometimes irregularly enlarged, perhaps by laborious respiration; they are dilated; or several are broken up into one. I know not whether this be disease or an original malconformation, having only seen the appearance in preparations—from which in no other instance in this work I have drawn my account.

OF THE STATE OF THE LARGE VESSELS IN ABSCESS, &c.—In large abscesses of the lungs, where they are in a manner degenerated into sacs full of matter: or in that still more extraordinary state of the viscus, where the lungs of one side is wasted to the mere bud of its root, and the whole side of the chest is left empty, with a mixture of pus and water in the bottom of it—the pulmonic vessels have been found with open mouths, as if opening into the chest! In general, in this state of the lungs, the vessels will be found contracted at their extremities for about an inch and a half, and cartilaginous to the feeling; or, instead of this, probably in a less advanced state, there have been found coagula formed in their extremities, plugging them up like the artery of a stump after amputation.

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* See an interesting litle tract on Inflammatory Affections of the Mucous Membrane of the Bronchiæ, by Dr. Badham.

From examining the state of large arteries, either when stopped by ligature or by an effort of nature, as in the formation of abscesses, it would appear that the formation of coagula depends much, if not entirely upon the coats of the artery. In ulcerated surfaces, and in the formation of matter (as in the present instance, in the lungs), the coats of the artery, partaking of the inflammation in which it is involved, and which extends from the surface ulcerated to the surrounding parts, form a clot by the exudation from the inner surface of the vessels, and partly from the mass of blood in its cavity.—And the clot thus formed has a firm hold upon the sides of the vessel, and an intimate connexion with it. It is the connection with the surrounding parts which supports the artery of an aneurism, or of a stump, after being tied. This connexion, by supplying its little vessel, gives support to its inflammation, and assists in the production of a healthy clot. But if the artery be left exposed in the middle of an abscess, or left dissected from the surrounding parts, then that part which is exposed will have no proper clot or contraction of its coats; but the coagulum which stops the bleeding will be found at that point of the artery which has a connexion with the surrounding flesh. If, again, the coats of a vessel tied in an aneurism be diseased, partaking of that ossified state which has already been fully described as accompanying the dilatation of arteries, they will probably be rendered by irritation unsusceptible of active inflammation: and upon the cutting of the artery by the ligature, there will be found no proper clot formed on the artery coalescing with its coats, so as in time to form a complete union; but, on the contrary, there is nothing to restrain the blood from flowing but the mechanical tying of the ligature, so that immediately upon the cutting of the artery by the ligature the blood escapes. It is certain, that in those dissections described by Haller and others, in which the mouths of the trachea and great vessels were seen projecting from a remaining bud of the lungs, the clots must have been formed a little within the mouths, and the vessels closed up in the common manner.

OF CONCRETIONS OF THE LUNGS.—Earthy concretions, I would be inclined to say, are frequent in the lungs. Sometimes they are united with abscess in the substance of the lungs. They are found in irregular cysts, crumble easily in the fingers, but take a stony firmness when dried. They grate upon the knife in dissecting the lungs; and, it would appear, are sometimes found in the extremities of the branches of the trachea: the greater masses are near the trachea. I have seen them so large as to press upon the aorta and upon the trachea, turning them from their seat.

OF BLOOD EXTRAVASATED IN THE LUNGS.—I have examined the lungs of those who have been suddenly suffocated from hœmoptisis. In a young man cut suddenly off in this way, the vessels in the neighbourhood of an abscess had given way and filled the whole bronchiæ, so that no air could be drawn into the air cells.

OF EXAMINING THE TRACHEA.—It will frequently be necessary to examine the inside of the TRACHEA through its whole length, as it is often the seat of disease. It may be necessary to examine it to know the cause of suffocation:—it may be compressed by tumours:—it may be eroded by obstinate ulcers; it may be inflamed, and polypous membranes may have been thrown out from its inner surface; or the coagulable lymph in hamorrhagy may attach to the surface, and being moulded to the branches of the trachea, be pervious like a tube. When the trachea is to be examined, in order to trace a disease which is connected with the lungs, the incision may be continued from the thorax upwards upon the fore part of the neck, and the trachea laid bare:—and being cut below the thyroid cartilage (or even the whole larynx being dissected out), it may be dissected from the œsophagus, and carried down to its bifurcation in the lungs; it being kept at the same time attached to the lungs by its branches. It can then be opened upon its back part, and slit down its whole length, when any polypous membranes thrown out by inflammation may be distinctly shewn, and traced in their progress in the lungs. When the trachea is replaced, and the incision upon the neck sewed up, the body is left in no way unseemly about the face; which in private dissection must always be avoided.

The dissection of the throat and its diseases are considered in the succeeding part.

DISEASED APPEARANCES IN THE MEDIASTINUM.—The posterior mediastinum which surrounds the great vessels that run down the spine behind the great viscera of the thorax, is not unfrequently the seat of disease. The lymphatic glands which lie at the root of the lungs are sometimes diseased; they are enlarged; or gritty matter is found in them which grates upon the knife; or they are found in a state of suppuration. Their disease will perhaps account for some of the symptoms which may have occurred during life; for they may be found to have compressed the trachea, the œsophagus, or the great vessels, the aorta, thoracic duct, or vena azygos.

When the conglobate glands are affected in one part, it will be commonly found more or less a general disease in the thorax, in the course of the aorta and iliac vessels, in the mesentery, &c. When abscess forms in the posterior mediastinum, it has no outlet, and it has been known to make very strange and extensive sinuses amongst the cellular membrane, even to have continued its course until it presented in the usual place of lumbar abscess, at the groin.

1. The ANTERIOR MEDIASTINUM differs in no respect as to its diseases from any other deposit of cellular membrane where there is much fat and many glands

and blood-vessels. 2. It is subject to inflammation and the formation of abscess. Matter here has destroyed and rendered carious the sternum, forming a soft tumour, with fluctuation above the bone. In such cases, the pulsation of the heart being communicated to the matter, an aneurism has been presumed, and the patien terrified with the idea of sudden death. 3. Although I have said that matter may destroy the sternum, yet I believe it is oftener the reverse, viz. that the scrophulous disease of the sternum fills the anterior mediastinum with matter. 4. A HYDROPS MEDIASTINI is spoken of, but it must be a singular occurrence. 5. The thymus has been found schirrhous, and concretions have been found in it, but I have seen no instance of the disease of the thymus.

A great accumulation of fat here has been considered as a serious disease, and even upon dissection assigned as the cause of death.

The premature accumulation of fat upon the viscera may be considered as a disease, though in old people it is natural. This load of fat upon the viscera is the last stage which the adipose membrane undergoes from the fœtus to old age. But the appearance of the fat, and the place of its deposit, are more changed than its quantity. It is not drawn from the extremities to the heart and viscera, but from the surface to the interior parts. In the fœtus, when the firm and unelastic integuments are dissected off, the muscles are left bare, and the further dissection is easy, the fat being firm and insulated, and external chiefly. Here the delicacy and neatness and beautiful form of the muscles and tendons will be as much the object of admiration as in the adult. The integuments of the fœtus in delivery is its great strength. In a youth, whose limbs have become shapely, the fat is more equally diffused over the interstitious cellular membrane, the dissection becomes more difficult. And in old age it has become still more tedious and impracticable; for every part oozes out oil, and the dissection can never be freed from fat. The fat, which to the infant gave unformed rotundity, and to the middle age symmetry and shape, has left the integuments, and is more equally distributed; it is now more accumulated about the internal parts, and more intimately blended with them. The fat does not remain in the cells any length of time, but, like the rest of the body, it must suffer a perpetual change; be resumed into the circulating system, as subservient to other uses, whilst the cells are at the same time filling with a new deposition. It is natural to suppose, that the state of the fat changes with that of the solids, and has a strict connexion with the economy of the body. Yet how insufficient is that explanation of the accumulation of fat about the viscera which assigns to it the use of rendering pliant and easy of motion these important parts, which are now stiff and inactive with old age! it is to suppose the most important viscera of the body to be greased like the wheels of an engine.

The membranes of the body, though loaded with fat, are not oily upon their natural surface: the attrition of surfaces in an animal body is prevented by their own secretion: and the animal oil, though it escapes, upon the adipose membrane being slit up, yet in the living body it cannot transude, to oil the moving parts. It is not long since the opinion was entertained, that the fat was laid in the track of the coronary vessels of the heart, to preserve them from those diseases to which the arteries were liable in other parts of the body, and the evil consequences of which would be manifold in the heart.

The PERICARDIUM is a strong white and compact membrane; smooth upon the inside towards the heart; never adhering to the heart but in disease; and moistened with a continual exudation. It supports the heart in its place, allows it free motion in its natural play, and restrains it in its inordinate actions. When we lay open the pericardium (by slitting it up on the fore part,) and expose the heart, the right ventricle protrudes; the right auricle is towards us; the left auricle is retired, and its tip is seen lapping round upon the left ventricle: from under this tip of the left auricle, a branch of the coronary vein and artery proceeds down to the apex of the heart. The course of these vessels may serve as a mark of the division of the ventricles by the septum, by which the cavities of the heart may be laid open; for they run parallel to the division of the two ventricles by the septum, and a little to the left of that division. If this mark, or the natural division of the ventricles, be not sufficiently distinct upon the outside of the heart, by grasping the heart in the hand, the left ventricle will be found firm, fleshy, and resisting; whilst the right ventricle is loose, and feels as if wrapped round the other. But these marks, by which the heart is to be dissected, will be afterwards observed more particularly.

Following up the right ventricle to the root of the artery disemboguing from it, we find the artery betwixt the two extremities of the auricles; then it seems to turn entirely round under the arch of the aorta; but it sends only the right pulmonic branch under the aorta, while the left goes to the lungs of that side. The aorta, again, seems to rise from the middle of the base of the heart, and takes a turn forwards from the left ventricle, which lies in a manner behind it.

Even in the uninjected state of the heart, it can be observed how it is placed towards the left side of the chest, and how in its position, in regard to the ventricles, it is oblique too; as that ventricle which is called the right is almost directly forward, whilst the left is behind, and almost completely hid by the right ventricle. It may also be seen how both ventricles rest upon the diaphragm, making the lower surface flat, as if moulded by its own weight, and forming its obtuse and acute margins; its point or apex being turned forwards, and towards the left side, so as to strike its pulsation upon the joining of the cartilaginous and bony part of the fifth rib.

Holding the pericardium from the right auricle, the inferior cava is seen coming up through the diaphragm, and the superior cava coming down from the upper angle of the pericardium, and behind that part of the aorta which is within the pericardium. A probe can be introduced behind the superior cava; in which case, the probe will be insinuated betwixt it and the veins going from the right lung to the left auricle. Upon lifting the heart from its place, and pressing upon the back part of the pericardium, it astonishes us at first to find the back bone projecting so far forwards, and resisting the finger. These marks are very useful in examining the parts in disease. It is useful to observe the situation of the heart in the breast; because, being held in the same position when it is taken out of the body, the manner of laying it open can be simply described, and the description of its diseases easily understood.

In tracing the pericardium up to its connexion with the great vessels, it is found to be reflected from those vessels over the whole heart, and to form the outer covering of the substance of the heart. But here it is more delicate, and of a totally different nature from the proper pericardium. When this membrane which covers the heart is considered as the pericardium continued and prolonged, we are obliged again to explain its situation, when entire, by the awkward supposition of a sac, emptied and laid upon the heart. In which case, the outward layer would represent the pericardium; and that which was in contact with the heart, the membrane of the heart itself. That the connexions of the pericardium may be understood, it is only necessary to lay it open: but to demonstrate it more completely, a tube and stop-cock may be introduced by a small puncture, and the pericardium strongly blown up: then the layers of the mediastinum may be dissected a little off it, and the connections at the root of the great vessels shown, with its vessels, nerves, &c.

It may be observed, in regard to the pericardium, that the heart is never what we would call completely filled; that is to say, the ventricles and auricles are not distended at once; but the action of these alternating with one another, the pericardium, instead of being alternately distended and relaxed, must, in the regular actions of the heart, be much more stationary than we are at first aware of. So, in injecting the heart, though the pericardium, being entire, may restrain the too great enlargement of the auricles or ventricles, yet it is no measure of the quantity of injection to be thrown in; and it can give no assurance of the heart being filled with its natural proportion of fluid; for either the quantity which belongs to two of the cavities of the heart may be divided among the four, or if all are filled to the utmost of their natural distention, the investing pericardium must be stretched beyond its due extent.

DISEASED APPEARANCES OF THE PERICARDIUM.

1. Upon opening the breast, there is always more or less water found in the pericardium. When the quantity is considerable, it is commonly accompanied with hydrothorax, or with general dropsy: the colour of the fluid takes a tinge from the blood after death, in the same way as macerating the heart in water

would colour the water, though the cavities of the heart were tied up.

2. The pericardium is supposed to have a greater proportion of water, because it has a greater degree of motion; but the additional explanation of Mr. John Hunter, viz. that the water may also fill up the interstices betwixt the rounded surfaces, though ingenious as applied to the pericardium, does not mark a difference betwixt other cavities and the pericardium. Even the smaller collections of water in the pericardium are frequently accompanied with similar collections of water in the other cavities of the breast, and even in the belly; but water, if contained in the pericardium, is at once observed; while the smaller quantities of water in the cavity of the breast sink behind the lungs, and are not distinguished. Extravasations of water into the pericardium are common in all lingering diseases, where the strength of the system is much exhausted some time before death. It is probably thrown out in the last feeble efforts of life. It is observed, that however much water there may be contained in the pericardium, still, upon dissection, this membrane is not found distended, but appears rather loose about the heart. This may happen from a deficiency of blood at this time in the heart, while in the living body the heart, during its utmost distention, may have been closely embraced by the pericardium.

3. Indeed I believe that all sacs containing fluid are less stretched on dissection than they were during life, and I imagine this proceeds from the function of the absorbents continuing longer than that of the arterial system.

4. In the pericardium there are often found spots of extravasation, the effect probably of recent inflammation. Sometimes the inflammation is more generally diffused over its surface; or we find adhesions formed at different points betwixt the heart and pericardium; and it happens, also, though rarely, that

the adhesions are complete in all the extent, uniting the pericardium with the whole surface of the heart.

5. Exudation of coagulable lymph is frequent within the pericardium. The lymph thus thrown out being by inflammation connected with both surfaces (with the heart and with the inside of the pericardium), is found drawn curiously into fibres; or perhaps taking a firmer hold upon the heart, and forming no communication with the pericardium, it is found adhering to the heart with an irregular and spongy surface, or sometimes it is curiously reticulated.

6. The pericardium is liable to a more permanent disease. It becomes thick, so as to be easily separated into layers like the coats of arteries. And although we should not suppose such membranous surfaces as the pericardium liable to such a disease, it has been found studded over with white schirrous tumours, containing pus.

Matter, too, is found upon the surface of the heart; for it is subject to ulceration. I have seen it irregular and foul, with disease upon the surface, and covered with a viscid matter; so that it seemed wonderful that the patient could have existed for a moment. In such a case as this, we may naturally expect to find the lungs adhering to the outside of the pericardium, and the pericardium to the heart.

7. I have seen a fracture of the ribs, form extensive sinuses with caries, affect the lungs, communicate disease to the pericardium; the pericardium was thickened, and contained much matter within it, a small opening communicated betwixt the sac of the pericardium, and an extensive abscess in the lungs. The substance of the heart too was diseased, the outer membrane greatly thickened, and a greenish, thick, and adhesive matter was upon its surface; yet here, in the last days of the man's illness, there were no

peculiar symptoms, nothing differing from a common hectic fever.

8. I have found the pericardium transparent; it was in a case of angina pectoris.

9. When the blood is found extravasated into the pericardium, it would appear that it is sometimes difficult to distinguish the rupture from whence the blood came; whether it was from the root of the aorta, from the erosion of the ventricles, or from the coronary veins or arteries. And in all ruptures it will be frequently necessary, after carefully examining the coats, to wash the heart out with warm water, and to syringe it gently into the great vessels, observing carefully from whence it escapes. When blood is extravasated into the pericardium, it does not support the action of the heart by its resistance to dilatation; but, on the contrary, the more that the pericardium resists, the more it must encumber the action of the heart: and when at last the disease proves fatal, it is by the extravasated blood suppressing the action of the heart; for in proportion as the action of the heart is great in propelling the blood betwixt the heart and pericardium, so must the compression of that blood be in resisting the future dilatation of the heart.

OF OPENING THE HEART TO DEMONSTRATE ITS INTERNAL STRUCTURE;—AND OF DISSECTING THE COATS OF ARTERIES.

Supposing the heart to be rudely cut away, with its vessels short, and to be held nearly in the position in which it lies while in the body, these marks may be observed:

First, The PULMONARY ARTERY is before the aorta; and these vessels are in a direction crossing each other. Secondly, Upon the left side of the pulmonary artery, the tip of the LEFT AURICLE appears; and under it a vein and artery, descending to the apex of the heart. Thirdly, The RIGHT AURICLE lies behind, and towards the right side of the aorta: a principal vein and artery are seen emerging from the fat at the base of the ventricle, and under the margin of the auricle; they likewise run down to the apex of the heart. If the great arteries have been cut close to the heart, the play of the semilunar valves may be observed by looking down into the vessels, and raising the valves by blowing upon them with the blow-pipe.

OF THE RIGHT AURICLE.—A small part of the trunk of the vein should be left unopened; for when it is entirely slit up, it will not be always easy to distinguish the mouth of the vein, nor, consequently, the situation of the parts as relative to the course of the blood.

Introduce a probe or blow-pipe into the lower cava, carrying its point to the projecting part of the auricle, which lies contiguous to the root of the aorta. Using this as a directory, the auricle may be slit up, by which the Eustachian valve, and every important part, will be avoided. Continuing to hold the heart nearly in the same situation in which it lies while in the body, the remains of the FORAMEN OVALE may be seen in the partition dividing the two auricles. This fossa ovalis is an irregular depression, of an oval form, with its border (especially upon its upper part) elevated into a ring. Its margin is white, and has somewhat the appearance of tendon. Within this there is a circle of those fleshy fibres which form the MUSCULI PECTENATI of the auricle; and the membranous part in the middle, which performed the office of a valve in the fœtus, is white and firm. This membranous part seems continuous with the margin upon the lower part, while, upon the upper part it goes behind the margin of the fossa: and here it may be examined with the probe, if the valve be still open, which it sometimes is.

If the lower cava, where it expands into the auricle, be held open, or if the vein be slit up with the auricle, then, by extending the part of the auricle upon the left side of the vein, there will be seen a membrane stretching from the inner side of the margin of the foramen ovale, round upon that half of the root of the vein nearest to the opening of the auricle into the ventricle.—This is the EUSTACHIAN VALVE: it is like a duplicature of the inner membrane of the auricle.

Behind the Eustachian valve is the opening of the great coronary vein; which vein, running round the margin of the left auricle, gathers the smaller coronary veins. The little semilunar valve on the mouth of this vein was likewise first described by Eustachius. —Several mouths of small veins may be observed near it, and having all little pellucid valves covering their mouths.

The opening of the auricle into the ventricle is to be observed, viz. *osteum venosum*. *Annulus venosus.*

When the auricle and ventricle of the right side are laid open, the circular margin of the valves being entire, the play of these tricuspid valves may be observed by holding out the auricle, and allowing the ventricle gradually to sink in water, when the valves will rise, and close the opening into the ventricle.

OF THE RIGHT SIDE OF THE HEART.—To open the RIGHT VENTRICLE, an incision may be made from the root of the pulmonary artery down to the apex of the heart, parallel with the right branch of the left coronary artery and its accompanying vein, which comes out from under the left auricle, but a little to the right of those vessels. By a cut made in this direction (care being taken to cut no deeper than the thin sides of this ventricle), none of the columnæ carneæ will be cut; for the ventricle will be opened exactly to one side of the septum of the heart: and being then enabled to see what parts are to be cut, the incision may be continued round the base of the heart, by the root of the pulmonic artery and margin of the right auricle: or the first incision may be continued round the point or apex of the heart, so as to lay it open as if it were cleft or split from the apex.

The action of the semilunar valves upon the pulmonary artery being examined from below, that artery may be slit up, and the inside of the right ventricle be displayed.

OF THE PARTS SEEN UPON OPENING THE RIGHT VENTRICLE.—First an irregular column of flesh is seen rising from that part of the ventricle which is laid back, and dividing into eight delicate cordæ tendineæ; and these are again expanded into a broad tendon, which is the anterior division of the tricuspid valve. From a little mammillary process of flesh, near the valves of the pulmonic artery, and where the surface of the ventricle is smooth, there is sent out, in three divisions, a great number of delicate cordæ tendineæ; and which are also connected with this anterior division of the valve. The next division of the origins of the cordæ tendineæ is from the septum of the two ventricles; from which they arise by separate little pillars of flesh. And, again, from the hindmost part of the ventricle there is a strong pillar of flesh, having a double origin from the two opposite sides of the ventricle, and to which the great posterior division of the membranous valve is attached. The transverse connections betwixt these muscular attachments of the valves should be observed. From these three divisions of this circle of membrane which surrounds the opening from the auricle into the ventricle, it is called the tricuspid valve. It must be considered rather as the ventricular valve of the right side than as the valve of the auricle; in the same way that the valve in the great artery is called the semilunar valve of the aorta.

The smoothness of the ventricle towards the opening into the pulmonic artery may be observed: and the pulmonic artery being slit up, the three semilunar valves of this artery will be seen. These valves are more frequently perforated in the edges than those of the aorta.

OF OPENING THE LEFT SIDE OF THE HEART.—Introduce the blade of the scissars into one of the pulmonic veins, and insinuating it into the part of the auricle which projects by the sides of the pulmonic artery, slit it up. Little is to be observed in this auricle: the MUSCULI PECTENATI are not so strong nor so evident upon its inside as those of the right auricle. The PULMONIC VEINS open almost always into four mouths; those from the right lungs being closer together than the left branches.

To expose the left ventricle, make an incision as far towards the left side of the vein which runs down from the tip of the left auricle to the apex, as the incision made to lay open the right ventricle was to the right of these vessels. In opening this ventricle there is less fear of cutting upon the columnæ carneæ, or upon the septum; as the right ventricle, being open, the septum is seen, and we can cut immediately on the other side of it; while the columnæ are collected in the further side of the ventricle, round the opening of the auricle, and are not much exposed to the knife. Continuing the upper part of the incision round under the projecting auricle, slit up the aorta to show its valves: in doing which, that branch of the left coronary artery which comes out under the margin of the left auricle must be cut through. When this ventricle is laid open, that part which is towards the septum is very little rugged with the interlacements of the columnæ carneæ, especially towards the opening into the artery. The fleshy columns, on the contrary, which are connected with the mitral valve (that valve which prevents the retrograde motion of the blood into the left auricle), are thick and short, and confined in a corner of the ventricle; nor do they spread their roots so extensively as those of the right ventricle. Two larger masses of these muscular columns, by which the valves are connected with the sides of the ventricle, may be observed. That which is before the other may be cut from its root, and thrown back with the portion of the valve to which it is connected.

The connections of these valves are so much alike in every essential circumstance to those of the right ventricle, that a description of the effect of the contraction of the muscular columns will apply equally well to both.

Turning our attention to the semilunar or sigmoid valves, we may observe, that in the child they are delicate and loosely floating membranes, variegated in part by a white opacity; while their edges are at some places so transparent, that there appears often to be real deficiences of the valve near the edge, when there is none.—There are, however, such deficiences sometimes. In the adult, these valves acquire greater firmness and strength, and are opaque. Behind each of these valves are seen the LESSER SINUSES OF THE AORTA.

The use of those cavities behind the valves has been often considered, but not satisfactorily explained: my opinion of their use is, they are intended to prevent the possibility of the valve being forced against the sides of the artery by the blood flowing from the ventricle. If no such provision were made, the blood would, upon the reaction of the artery, have no power upon them to throw them down upon the ventricle. But by this sinus or cavity behind each of the valves, they are held as if in the middle of the stream of the retrograde blood; and in its first movement backwards, they are forced together so as to prevent the regurgitation of the blood into the ventricle. The mouths of the coronary arteries open behind the two valves which are upon that side of the aorta, contiguous to the pulmonary artery.

It is disputed whether these semilunar valves affect the passage of the blood into the coronary artery. But though the valves were thrown so close upon the sides of the aorta as to close the mouths of the coronary arteries during the systole of the heart, still that quantity of blood, which is behind the valve upon its being thrown back, would as effectually be propelled into the coronary arteries as if no valve intervened.

See, below, Diseases of the Heart.

OF THE ACTION OF THE TRICUSPID AND MITRAL VALVES;—AND OF THE EFFECT OF THE CONNEXIONS OF THE COLUMNÆ CARNEÆ.

The disputes and variety of opinions about the action of the tricuspid and mitral valves have arisen from the supposition, that the columnæ carneæ were merely the attachments of the cordæ tendineæ to the flesh of the ventricles. And, upon this supposition of their inactivity, the whole attention was bestowed upon the contraction of the ventricle, and the approaching or retiring of the apex of the heart from its base during its action. Nor does it seem ever to have been considered what is the peculiar connexion of the roots of the columnæ carneæ to the parietes of the ventricles, or what effect the dilatation of the cavities of the heart must consequently have upon them.

But since those connexions of the membranous valves of the auricle are only in part tendinous, while much of their length is muscular (viz. the columnæ carneæ), it is natural to suppose, that those muscular columns are synchronous in their action with the sides of the heart itself, with which they are intimately blended. While the action of the auricle is dilating the ventricle, and the cavity of the ventricle is distending in every direction, the cordæ tendineæ will be stretched, and the attached muscular columns will be relaxed, while the heart itself is relaxing. And it may be observed, that in whatever direction the ventricle is dilated (whether in its transverse or longitudinal diameter), the connexions of the little muscles attached to the valves are such, that they must be extended and relaxed.

Again, during the contraction of the ventricle, the columns of Lower contracting also (the musclar fibres of both having been excited by the distention of the ventricle) as the apex of the heart approaches the base to which the valve is attached, the cordæ tendineæ are shortened by the contraction of their muscular attachments:—and by this means the valves are restrained from being inverted, and the blood from escaping backwards into the auricle from the contracting ventricle.

This explanation of the action of the columnæ carneæ does not rest upon the presumption of the elongation of the heart in its axis; which is a disputed point. For if the connexion of these little muscular columns be attended to, it will appear, that their elongation and relaxation must take place during the filling of the heart with blood, in whatever direction the ventricle is dilated by the influx of blood. For instance, in the right ventricle, the larger pillars connected with the valves have their base rising from the three opposite sides of the heart; and the lesser columns run in a direction across the cavity of the heart, —or cross bridles may be observed, which, being fixed into the longitudinal columns, must elongate their fibres upon the dilatation of the ventricle in width. And it may be observed, that by the contraction of the fleshy roots of the chief columnæ they have a greater combined effect upon the point, or pull it through a greater space, in a middle course, directly in the axis of the heart, than if the column of muscle attached to the valve ran in a direct course from the valve to the apex of the heart. And it will readily be conceived, that the relaxation of the muscular power in these decussating fibres of the columnæ carneæ, will allow an equal latitude to the lengthening of the cordæ tendineæ (inversely as their powers of contraction), when the heart is dilating by the influx of blood from the contracting auricle.

It will (by this explanation) be at once understood, how very imperfectly experiments, by filling the dead heart with water, will illustrate the play of the valves in the living body.

OF THE DISSECTION OF THE COATS OF ARTERIES.

To prepare the coats of an artery neatly, it should be injected with coloured tallow, and its coats dissected and pinned out; or the dissected coats may be transfixed with a strong bristle, to keep them separate.—It is then to be preserved in spirits. To show its inner surface, it may be opened, the injection picked from its cavity, and its sides held separate. Even where we have to examine diseases, as in aneurisms, in ossifications of the coats of the arteries of the extremities, in stumps after amputation, or in diseased lungs, &c. we may still have the vessel injected.

For the manner of demonstrating the muscularity of arteries, I must refer to the Introduction, p. xiv.

There are, four coats in an artery;—the outer cellular coat—the muscular coat—the inner cellular coat—and that coat which forms the inner surface of the artery. To dissect the more numerous divisions of the coats, as described by some authors, the chief dependence must be placed upon the outer cellular coat; for this coat may be separated into layers making up any number of coats, while the others are more distinct, with something like a natural division between them.

The common cellular substance, which surrounds the arteries loosely, more or less, through the whole body, forms sheaths, which, in the dissection of some parts, it is necessary to preserve. Of this kind, is the sheath which surrounds the carotid artery, jugular vein, and eighth pair of nerves, in the neck. When an artery is cut across, it contracts and buries its mouth in the sheath. It is very necessary often to shew the situation of vessels in regard to the bed of cellular substance and fat, in which they lie. Indeed nothing is of more consequence to the surgeon; for if we are taught the anatomy of accurately dissected muscles only, and of injected vessels cleared from all confusion, we can scarcely hope to recognise an artery in an operation on the living body. In a demonstration, therefore, if the students have not seen the whole progress of the dissection, some part of the artery should be left in its native confusion.

The EXTERNAL CELLULAR OR VASCULAR COAT.—By this coat the artery is connected with the parts in which it lies imbedded. It is covered in the great cavities by the general investing membrane, as the pleura or peritoneum. The small arteries which ramify upon the larger trunks of arteries (the VASA VASORUM) run chiefly in this external coat. These arteries are not, in general, derived from the larger vessels on which they lie, but come from some of the surrounding smaller branches of arteries. They are to the great arteries as the coronary arteries are to the heart. They supply and nourish the coats of the arteries, while the column of blood in their cavities seems to have no such effect. To prepare these subordinate vessels, they must be injected minutely (while they lie in situ) with size, or fine varnish injection, of a light colour, or of pure white If after this minute injection a coarser and dark-coloured injection be thrown into the trunks, the light-coloured and fine injection will be pushed onward, while the coarse injection fills only the trunks; making thus a contrast between the large vessels and the ramifications of the vasa vasorum upon its surface. The artery, when thus injected and prepared, may be dried and varnished or preserved in spirits.

The outer cellular coat of an artery may be separated into many layers; easily into three layers. These layers are gradually, as they proceed inwards, changed in their nature from that of the general investing cellular membrane, and are at last incorporated into a more regular coat, which has been called the *tendinous coat;* it is dense, white, and elastic; and has much more toughness than the inner coats. It may be useful to observe, that it is this coat, according to Haller, upon which depends the tortuous shape of arteries; and that when it is taken off, the artery loses its peculiar character. It is to be understood then, that while the inner surface of this coat, viz. that which is contiguous to the muscular coat, is more accurately defined, its outer surface seems imperceptibly to degenerate into the nature of cellular substance.

The MUSCULAR COAT.—Having dissected these outer layers, the muscular coat appears. Its fibres run in circles round the artery; no fibres run in the length of the artery. The circular fibres of the muscular coat do not pass in the whole circle. On attempting to trace any single fibre, it may be found to make a complete circle round the artery; but, on further examination, the circle is made up of segments of fibres irregularly combined, the extremities of which are intermixed, and seem lost among each other.

The INNER CELLULAR COAT.—In dissecting a diseased artery, with concretions formed in its coats, the concretions are, upon lifting the muscular fibres, found situated in the INNER CELLULAR COAT; if, indeed, it deserves the name of a coat, since it is rather a connecting medium betwixt the muscular and the innermost coat of all. This inner cellular coat is difficult to be demonstrated;—but by slitting up the artery, and tearing off its innermost coat, the existence of this one may be shewn; it appears, also, in the ossified state of the artery, when the concretions are seen under the muscular coat upon the outside, and adhering to the innermost coat upon the inside. In a recent and healthy vessel, there is great difficulty in dissecting or tearing off the INNER COAT, unless a degree of putrefaction have taken place. The inner coat is dense and smooth; it possesses considerable elasticity, though it is not so tough as the outer coats of the artery.

OF THE APPEARANCE OF DISEASE IN THE COATS OF BLOOD-VESSELS.

Before speaking of the diseases of the arteries, I think it necessary to say a few words on the effect of ligatures on them. The experience of the dissecting-room teaches us that if, in preparing for injection, we tie the artery too tight, we feel the ligature suddenly yield, and we find, on examination, that the inner coats have been cut, and only the outer coat remains entire. If we are inattentive to this, the injection will escape here. I have made this the foundation of a caution to the surgeon, to take care in tying an artery, especially if it be diseased, that he do not thus cut it through. Mr. Jones, in his treatise on hemorrhagy, has drawn a very different, and, I think, an unwarrantable conclusion on this subject. He will have the artery cut by the ligature that it may adhere. "In the case of an artery, we perform an operation on it, to put it in the state of a simple wound: *i. e.* in a state in which adhesion may take place; and this operation consists in the application of the ligature, which, when properly applied, cuts through the internal and middle coats of the artery, keeps their cut surfaces in contact, and affords them an opportunity of uniting and cicatrizing, as other cut surfaces do, by the adhesive inflammation." "It is well known, that, generally speaking, we can only obtain union by the first intention, in clean and simple incised wounds; consequently, it is only in such wounds. of the arterial coats that we can reasonably expect it; and hence it is obvious that we should take the utmost care to use the ligature of the form, and to apply in the manner, most conducive to the formation of such a wound."

In the first place, I deny that cut surfaces adhere more readily than a natural surface, in a state of inflammation. The effect of the ligature ought to be the inflammation of the coats of the artery, and the preservation of the inner surface in contact. Much as I admire the ingenuity of Mr. Jones, yet an experiment has been made in my rooms, which throws more light on the subject than twenty experiments of cutting the artery. A ligature was put about an artery, quite loose, and without obstructing the blood, in due time the clot was formed, and the coagulable lymph was thrown out, and the artery obstructed. Yet, from fifty such experiments, uniformly successful, it would be madness to say that, in tying an aneurismal artery, we were not to draw tight the ligature, but only leave it there surrounding and causing inflammation of the artery! I conceive it little less rational, because cutting the inner coats of an artery in brutes is followed by the closing of the artery, to say, that, in an operation of aneurism we were to draw the ligature till we felt the giving way of the inner coats. This subject I should be happy to pursue further, but I am limited to the mere expression of dissent to such dangerous doctrines.

Both arteries and veins are liable to have concretions formed in their coats; but in the veins it is an uncommon disease, and, apparently, the concretions are different in every respect from those found in the coats of arteries. Concretions in the arteries have been long a subject of inquiry; and it is one which indeed involves much matter of practical importance in its discussion.

The INNER CELLULAR COAT is more particularly the seat of ossifications, or more properly, of concretions. Steatomatous tumours, also, I have observed originating in the cellular substance, behind the inner coat of the aorta, and partially filling up the artery. The aorta has been totally obliterated by such tumours, and the circulation carried on by the inosculation of the thoracic and epigastric arteries, by the inosculations betwixt the phrenic, and cœliac, and mesenteric arteries. Before we can conceive that the minute branches of these extended arteries could perform the circulation of the blood through the pelvis, and thighs, and legs, we must recollect, how slowly such obstruction approaches, and how unlike the instantaneous obstruction in the tying of arteries.

Pus is described by some authors as found in this internal cellular membrane; but it is more probable, that it was that kind of matter which surrounds the concretions.

OF CONCRETIONS.—In accounting for dilatations in arteries, too much importance has been given to concretions, while the general state of the artery has been overlooked: concretions are more of the nature of an accompanying evil; and only one of many forms which diseased arteries assume. These concretions are situated betwixt the inner membranes of arteries and their muscular coat. They are of two kinds. More generally, they appear upon the inside of the artery, yellow and irregularly concreted tubercles; and upon the injection and drying of the artery, they raise its surface into irregularities. It is in this state, that, upon opening them, they are frequently found surrounded with matter, thick, and of the same colour with the concretions. This led Haller to the explanation, that these ossifications, as they are commonly called, are concreted from a fluid matter deposited; in opposition to the opinion, that the matter is formed in the surrounding coats by the irritation of this foreign substance causing ulceration. Were this fluid matter produced by ulceration, we could not conceive that the artery should be able to sustain the force of the blood for an instant, or what limits should be set to the ulceration.

This matter surrounding the concretions was observed by the older anatomists; but was considered rather as a circumstance confirming them in their opinion of the concretions being true bone; for this they considered as the marrow.

In the broad scales, which more resemble bone, this fluid matter is seldomer found. Such broad scales are frequently found almost completely surrounding the artery, without any dilatation or aneurismal enlargement of the artery; while the more irregular tubercles are common in the enlarged arteries. Often we find the whole arteries of the pelvis and thigh, with thin coats, so full of ossification, that they stand rigid and open when dried.

Rupture, from the scales formed in the coats of arteries, happens very seldom in the great arteries of the trunk. From the cases on record, it would appear, that the fair rupture of the aorta takes place more frequently within the pericardium, and at the root of the heart. I have known it happen in the posterior mediastinum.

It is wonderful that the larger trunks of arteries, where they lie in an even course, are sometimes surrounded with scales of these concretions, while yet they seem to perform their functions. Ossifications in the lower part of the aorta and iliac, and femoral arteries, are very frequent without dilatation. These instances would alone teach us how passive the great trunks of arteries are, compared with the extreme branches.

Of the cause of aneurisms.—In aneurisms of the great arteries, the coats are found thickened, firm, and easily separating into layers, almost constantly, with concretions formed in them, and with their elasticity remarkably diminished. These ossifications have been always assigned as the cause of enlargements of the arteries; but the degree of the enlargement, and its place in the artery, do not seem affected by the ossifications. If these ossifications caused the enlargement of the artery, by acting mechanically by attrition and destruction of its coats, they would produce, not a gradual and extensive enlargement, but a partial and sudden one; such as we find in the extremities. It has been said, that the ossifications in the coats of arteries occasion greater resistance to the dilatation caused by the action of the ventricle of the heart; and that this resistance exciting the heart to greater action, it becomes at last so great as forcibly to dilate the artery. A strange subtilty, to make the strength of the artery the cause of its being overpowered. It is said again, that these ossifications destroy the muscular coat of the artery; and, consequently, rendering it incapable of withstanding the stroke of the heart, it ceases to second the stroke of the heart, and suffers itself to be dilated. But the muscular coat of an artery is not that which resists the passage of the blood, or rather the dilatation occasioned by the force of the ventricle; the muscular coat is alternate in its action with the heart. During the contraction of the heart it is in relaxation, and it is only when the heart intermits its action that the muscularity of the greater arteries acts in resistance to the muſcularity of the extremities; whose combined power would repel the blood back to the trunks, and dilate them, were the greater trunks not enabled to resist by the additional action of their muscular power. The power of resistance in the arteries near the heart to the blood propelled from the ventricle, depends on their elasticity. This is a power which yields, yet resists. By its yielding, and yet its uniform increasing resistance, even to the utmost stretch of its elasticity, it subdues that shock which the great vessels would otherwise receive from the sudden exertion of the heart. Now we observe, upon dissecting the coats of dilated arteries, that the whole functions of the vessel must be impaired; the coats are thickened; are easily divisible; and have loſt their elasticity. And upon examining the length of the aorta, when thus diseased, it is found dilated; not uniformly where the ossifications are most numerous or longest, but often where there are no hardenings or concretions in the coat; on the other hand, whole tracts of ossification will be found without any dilatation of the artery. In this state, the arteries can no longer dilate upon the action of the heart, and uniformly resist and contract again; but, on the contrary, there is a more solid and inert resistance to the impulse of the heart, their coats being thick and unelastic: so that every contraction of the heart gains a point in the permanent enlargement of the artery, which (unlike the dilatation of elasticity) is never regained. Thus, although the artery be actually strong in its coats, and dilated and filled with firm coagula of blood, yet will the impulse of the heart gradually encroach upon this inert resistance. While the thin and limber coats of the natural artery will resist the heart's action, never yielding in the slightest degree through a long life.

CAUSE OF DILATATIONS BEING MORE FREQUENT IN THE CURVATURES OF ARTERIES.—The arteries are more generally dila~~ted at~~ their curvatures, or where branches are sent off. The reason of this is evident, if we allow the above explanation of the cause of dilatation in general. Those who have paid much attention to the structure of arteries, have found, that where an artery sends off a branch, or takes a sudden turn, its coats are strengthened to resist the action of the blood, which must be greater at these points: and as this increase of strength must consist in a more powerful elastic and pliant resistance to the current of blood propelled by the heart, combined with such a proportion of muscular power as to react equally with the rest of the canal; so, on the other hand, when the coats of the artery become diseased, they bring the artery to the state of a rigid tube; and the force of the heart becomes more quickly perceptible at those points which are most exposed to the current of the blood, and where that power, which formally resisted in a greater degree, is now reduced to the same state of inactivity with the rest of the tube. Thus we find dilatations more frequent in the curvature of the aorta, at the root of the great vessels going to the head and arms; and in the belly; at the cœliac, and emulgent, and mesenteric arteries; or at the joints.

Of aneurisms in the extremities.—This explanation of the cause of dilatation may be extended to the aneurisms of the arteries in the extremities; where we almost constantly find the enlargement of the artery at the part where it lies in the great joints, as in the groin or ham. But in the aneurisms of the extremities there is often another cause of dilatation, which arises from the mechanical effect of the concretions in the coats. In dissecting the tumour of the artery, it is frequently found not to be a uniform dilatation of the coats of the vessel, but the artery is seen upon one side of the tumour, and resembles that aneurism which is formed by the puncture of the vessel, and by the blood escaping from it into the surrounding soft parts, and forming a sac. Wherever I have had an opportunity of examining the artery, it was much ossified and diseased above the tumour; a circumstance always to be dreaded in attempting the operation when it is an aneurism of the dilated coats.

These concretions in the coats form gradually; and they adapt themselves to the shape of the artery in the prevailing posture of the limb. If the leg be for the most part stiff and rigidly extended, upon any violent exertion the artery is bent, and its coats torn upon the edges of these concretions. On the other hand, if the limb be shrunk up and contracted, the artery being at the same time diseased in much of its extent, there may be formed a scaly concretion, of a curved form, answering to the bend of the artery at the joint, as in the ham or groin; and in this case a violent attempt to stretch the leg will rupture the artery, since it must bring it to an angle differing from that of the scale which has been formed in its coats. There are cases of this kind upon record.

More particularly of the great aneurisms in the breast.—While slight dilatations are very frequent in the aorta, as it proceeds from the heart, and in its great arch; it is universally observed, that dilatation of the pulmonic artery is very rare. When the dilatation of the aorta has proceeded a certain length, it rapidly increases. It seldom happens that the artery is much diseased near the heart, without being in some degree enlarged through the whole length of the aorta. Aneurism never is in its commencement a local disease. But when the dilatation of the artery has proceeded thus far, it generally, at some one point, gives way more easily; so that the dilated sides of the artery are pushed towards the root of the neck, or, being forced directly forward in the chest, come in contact with the sternum. The bone for some time interrupts its progress; but by the continued impulse from the heart, the coats of the artery seem to be worn away in the pulsation against the bone; while, on the other hand, the periosteum and membranes which cover the bone are entirely destroyed, and the bone itself is absorbed. Or sometimes the dilated sac of the artery, stretching widely under the sternum, finds a less resisting passage betwixt the cartilages of the ribs, destroys their membranes, and, protruding, raises a beating tumour externally upon the breast. When this happens, there are generally two tumours; the tumour of the one side appears before that of the other, and commonly they rise upon each side of the sternum, about a hand's breadth below the clavicle.

Dissection.—To examine the state of the parts, we may proceed thus: dissecting off the integuments from the breast in the usual way, they may be laid back until the tumours on each side of the sternum are completely laid bare. But it may happen, that when the dilafation has proceeded freely in this direction, the skin (if it have not actually burst) is stretched and inflamed, and has become as it were one substance with the sides of the cyst, and cannot therefore be dissected off. When the integuments are still loose, upon taking them off, the pectoral muscle is found with its fibres thinly scattered over the protruding sac, and strengthening it; and the sac itself appears to be composed of condensed cellular membrane, with something like the natural coats of the artery forming its inner layer.

If it be intended to make a preparation of the diseased parts, the sternum being loosened from its attachments, the heart may be taken out alongst with it, and afterwards displayed with the dilated artery pushing through the interstices of the ribs. It, however, seldom happens that we can be thus far masters of our time in dissection. When the sternum is raised in the common way, the tumour of the aorta is found adhering with a broad circumference to the under side of the sternum: this must be cut through, and with the coats of the aorta we must cut much hard coagulum of blood.

Upon examining the under side of the sternum, the bony part of the sternum will in general be found wasted by the blood. Sometimes the cartilages, also, are found wasted; but they seem better to resist the blood. The blood must affect the bones by exciting the absorption, or preventing the deposition of the boney matter, by its mechanical action. Upon examining the aneurismal sac, it will be found greatly thickened, irregular, with white callous scales or tubercles, imbued with a matter resembling pus; and, upon the inside of the sac, lamellated clots, partly resembling membranes, partly concreted blood, will appear. Upon turning the attention to the heart, it will, I think, be found small and firm in its texture, and forced lower down in the breast. Upon looking down into the dilated aorta, the valves appear thickened and white with concretions.

In thus describing the manner of examining these aneurisms of the great arteries, the most common circumstances attending them have been detailed; yet a great variety of appearances may present themselves to us. The clots which fill up the great bag of the tumour should be examined, that we may acquire some idea of their progressive formation; for this may perhaps explain some of the symptoms during the patient's life, as the sudden subsiding of the tumour, its more suppressed pulsation, &c. Or the tumour of the artery may be found compressing the trachea or lungs, or encroaching upon the cava, or in some more immediate way affecting the respiration or the circulation of the blood. When the aneurism forms in the posterior mediastinum, the tumour pushes out by the side of the vertebræ of the back.

Of the veins.—Dilatations of the veins near the heart never happen but as a consequence of the dilatation of the right side of the heart with blood; and in that case it is not a permanent increase of size in the veins, but a dilatation from the occasional fulness, caused by the difficulty of circulation in the heart:—I have not seen the veins near the heart enlarged or varicose.—A remarkable diminution of size in the veins near the heart is more common. I have found the superior cava no larger than a goose-quill. I had no opportunity of observing the effect of this during the patient's life: but the size or fulness of the heart seemed in no way affected by it.

There are instances of the great veins being quite impervious; a fibrous polypus-like matter, or hard fleshy substance, or a fatty medullary-like substance, filling up their cavities. And that they were impervious during life was confirmed in these instances, by the smaller veins being dilated to carry the blood; in one case, the spermatic vein in the belly;

and in another instance, the vena azygos in the breast performed the office of the cava. There have been found in the lesser veins (in those of the pelvis, and parts of generation, it would appear, more frequently) little stony concretions, round, and sometimes moveable. Ruptures, too, of the great veins are said to have happened; but this is a very rare occurrence. I have seen, however, a tumour seated upon the abdominal cava, which seemed to have destroyed the coats of the vein; for a spongy tumour projected into the cavity of the vessel, and the blood seemed to have exuded into the tumour which covered all the roots of the cœliac, upper and lower mesenteric arteries. The peculiarities in the veins of the extremities come afterwards to be considered.

FIFTH DISSECTION

OF THE

THORAX.

Of the Injection and Dissection of the Heart and adjacent Vessels.

Old subjects should never be taken for the purpose of preparing any of the viscera: for the fat is in old age accumulated about the viscera, both of the abdomen and of the thorax. Nor is the fat deposited here derived from the extremities; for although the limbs of old people seem, during life, shrivelled and lean, yet the oil contained in them makes them also useless for preparing:—although dried with the utmost care, they sweat out grease, which mixes with and dissolves the varnish; and they never make clean nor lasting preparations. If the heart, therefore, has much fat accumulated about it, there should be no hesitation in sacrificing it as a preparation, to the attainment of some other point of inquiry, as the examination of its internal structure.

To make a good injection of the heart, it is necessary to have the coagula well washed from its cavities; to have it well heated; and to pay particular attention to the filling of the coronary vessels, upon which the beauty of the preparation much depends. The coronary veins, and even the arteries, may be injected separately, by introducing a long tube down the cava and aorta; or the fine injection may be thrown in in this manner; while they are filled with the coarse injection, at the same time that the cavities of the heart are injected. By this means the surface of the heart is beautiful, the minute ramifications of these vessels being filled with colours answering to the colour of the injection in the right and left sides of the heart. The right side of the heart will be most advantageously injected from the left jugular vein, or the injection may be made by any of the other large veins. From any of these, the right auricle and ventricle, with the pulmonary artery and coronary vein, will be filled. The left side of the heart may be injected from the aorta below the diaphragm, or from the axillary or carotid arteries of either side. By this injection all the arteries of the breast will be injected; the coronary arteries; the left ventricle (by the wax breaking down the valves of the aorta); and from the ventricle the wax will find its way into the left auricle, and into the pulmonary veins. If in filling the heart, the injection, by flowing down upon the vessels in a full stream, should raise the valves, either in the aorta on in its passage into the auricle from the ventricle, the valves may, by kneading or irregularly compressing the heart, be moved from their hold, and the injection have access to the whole side of the heart: but to prevent the possibility of the valves of the aorta being shut by the injection, they may be lacerated by introducing a probe down the aorta; or a tube may be introduced into one of the pulmonary veins, though this will be seldom necessary. In injecting the veins, the vena cava may be tied above the diaphragm, or it may be tied below the liver, by which the venæ cavæ hepaticæ will be filled.

The THORACIC DUCT may also be injected. If sought for in the abdomen, it will be discovered at its dilated part, at the root of the mysenteric vessels; or upon the left side of the aorta, where one of its branches runs under the aorta; it is then seen going up under the diaphragm, along with the aorta, and upon its right side, close to the spine. In the thorax, it may be discovered running up betwixt the aorta and the vena-sine-pari. If it lie collapsed and undistinguishable, it may be raised by blowing into some of the glands upon the root of the mysentery, or into those upon the course of the external iliac vessels, or even into those without Poupart's ligament in the groin. It must be injected with a different colour from the veins, that it may not be confounded, in the thorax and at the root of the neck, with the branches of the veins.

In injecting the heart when out of the body, the numerous branches of the subclavian arteries and veins, and the intercostal arteries coming off in the whole length of the aorta must be tied. And to make sure that all vessels are tied, except those into which the tubes are to be introduced, let the heart and lungs be laid in a flat bason, and covered with water; then, by blowing into the principal trunks, all the open mouths of arteries will be easily detected.

OF THE VESSELS TO BE TRACED IN THIS DISSECTION.

In the first place, the pericardium being dissected off, all is made clear for the dissection of the heart and great vessels:—then the fat which obscures the coronary vessels is to be dissected away;—the great coronary vein is to be shewn encircling the base of the heart, and emptying itself into the right auricle:—the right and left coronary arteries are also to be displayed: they need little dissection, but upon the base of the heart.

In dissecting betwixt the aorta and pulmonary artery, there may be observed a kind of ligament between them, which is the remains of the DUCTUS ARTERIOSUS. The branching of the pulmonic artery to the lungs of each side being dissected, and the right branch followed under the arch of the aorta, and the branches of this artery, and the pulmonic veins, displayed for some way ramifying in the lungs—we must proceed with the aorta as it rises from the heart, where it is called the ascending aorta. In young subjects, the THYMUS must be attended to: it is to be lifted from the pericardium and great vessels, and folded over upon the neck. Its blood-vessels will be found coming out from the root of the internal mammary artery of each side, and attached to the thyroid or tracheal veins. Upon the top, or utmost convexity of the aorta, three important arteries are sent off on the right side: the arteria innominata which quickly divides into the right subclavian and right carotid arteries; the middle artery is the carotid of the left side; the other is the subclavian artery of the same side.

But the SUPERIOR VENA CAVA, and the trunk common to the jugular and subclavian veins of the left side, cross before these important arteries*. The superior vena cava, shooting up from the right auricle, and having escaped from the pericardium, is joined upon its back part by the VENA AZYGOS. This vein coming forward in an arch from the spine, upon which it creeps to one side of the aorta, and before the intercostal arteries, pours its blood, (gathered from the back part of the chest) into the superior current of blood. The vena cava, having got a little higher than the arch of the aorta, stretches a great arm (the left subclavian vein) across the top of the chest, and before the root of the arteries which go to the head and arms. This branch, dividing into the internal jugular and the subclavian veins, receives the blood from the left side of the head and neck, and from the left arm: and at the angle formed by the joining of the internal jugular and subclavian veins of this side, the THORACIC DUCT empties itself into the circulating system.

OF THE LESSER VEINS.—The VENA MAMMARIA INTERNA of the right side joins the upper part of the superior vena cava; upon the ſeft side joins the subclavian vein, opposite to the cartilage of the first rib. The DIAPHRAGMATICA SUPERIOR, OF PERI-

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* As the right auricle of the heart lies upon the diaphragm, the inferior vena cava must be very short. If the VENA AZYGOS had emptied itself into the vena cava at this place, it must have climbed upon the diaphragm, and joined the cava within the pericardium. It follows the general course of the veins of the thorax, which go to terminate in the branches of the superior vena cava, where there is more easy access to them.

CARDIO-DIAPHRAGMATICA, on the right side, joins the vena cava at its bifurcation; on the left it joins the subclavian below the mammaria. The THYMICA, on the right side, sometimes joins the vena cava; sometimes the gutturalis or thyroid vein, or some neighbouring branch: on the left side it empties itself into the subclavian vein. The RIGHT PERICARDIAC VEIN enters the root of the right subclavian vein: on the left side it joins the subclavian vein, or the diaphragmatica, or the mammaria interna. The THYROID VEIN, or TRACHEALIS, or GUTTURALIS of the right side, is inserted into the bifurcation of the vena cava: on the left side, into the upper and back part of the left subclavian. The distribution of these veins is described in their names. It is for the most part very regular; but their communications with the larger veins are very inconstant, and differ in each side as the great trunks are different. There is little use for a minute knowledge of these vessels, unless that we may be able to tie them in injections.

OF THE LESSER ARTERIES.—The SUBCLAVIAN ARTERY is the great source of the numerous smaller arteries which ramify in the thorax, upon the mediastinum and pericardium, and upon the under surface of the sternum; and of those also which seem to come out from the thorax to be distributed upon the root of the neck and shoulder.

The INTERNAL MAMMARY ARTERY of the right side is the first branch which the subclavian artery of the right side gives off after parting with the carotid. It is seen running upon the inside of the cartilages of the ribs near the sternum: It supplies much of the contents of the thorax anteriorly; and inosculates with the epigastric branch of the femoral artery upon the abdominal muscles.—It gives off the ARTERIÆ THYMICÆ, it sends branches through the ribs to the muscles and integuments. See Appendix.

The INFERIOR THYROID ARTERY is the second branch of the subclavian artery, and is subdivided into these branches; it ascends towards the throat. See Appendix.

The VERTEBRAL ARTERY, going from behind the subclavian artery, enters the vertebral hole of the sixth vertebra of the neck.

The SUPERIOR INTERCOSTAL ARTERY, with its accompanying vein, can scarcely be dissected while the contents of the chest are in their place, as it lies close to the joining of the upper ribs with the spine, and comes from the back part of the subclavian artery.

All these arteries are more accurately described in the Appendix.

In preparing for the dissection of these vessels, the reader may observe the general distribution of the nerves, and mark the points at which they are complicated with the arteries and veins. See that part of the work which treats of the dissection and general course of these nerves, from the base of the skull through the neck, thorax and abdomen.

To continue the dissection of the aorta, as it lies upon the spine deep in the chest, the lungs, and even the heart, would need to be taken away, to have a full demonstration of its branches, which are but few and insignificant. But by folding back the lungs from one side of the chest, any thing important may be sufficiently observed. Or the ribs may be cut down on the left side, and the parts in the posterior mediastinum carefully dissected. The bronchial arteries; the œsophageal and intercostal; the œsophagus, and 8th. pair of nerves; the thoracic duct, &c.

GENERAL VIEW OF THE ACTION OF THE VASCULAR SYSTEM, AND OF THE ACTION OF THE DIAPHRAGM AS AFFECTING THE HEART;—BEING INTRODUCTORY TO THE DISEASES OF THE HEART AND VESSELS.

THERE are a few leading points in the action of the vascular system, which being acknowledged and kept in view, will enable us to examine with advantage the morbid appearances in the heart and adjacent vessels; or their preternatural structure, as in monsters, or in the imperfect animals. And as the appearances which we have to expect in morbid dissection are perpetually varying, to proceed at once to a detail of those appearances, without settling the principles upon which our estimation of their importance is to be formed, must expose us to continual difficulties.

It is necessary to recollect the situation of the heart in relation to the surrounding parts, and to consider how its motions are regulated.

When the diaphragm, which divides the thorax from the abdomen, is pulled down, and the thorax is expanded, and the lungs consequently dilated, it is natural to inquire, What effect this expansion will have upon the heart, or at least upon the great veins and auricles? As they lie within the same cavity with the lungs, they also would be dilated, or their action in some measure affected, by the vacuum * thus

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* It will not be understood that I mean here a separation betwixt the lungs and the inside of the thorax and an actual vacuum, but simply the tendency which the dilatation of the thorax has to expand any cyst whose cavities can be filled from sources external to the thorax; as the lungs, by the atmospheric air drawn through the trachea.

formed in the thorax, were there not a particular mechanism to counteract it. By the connection of the mediastinum with the heart, by its reaching to the upper part of the thorax and surrounding the great vessels, and by its being stretched over the pericardium, or rather intimately connected with it, and forming its outer coat—it embraces the cavities and tubes which circulate the blood. By this means, the heart is so situated, that the effects of that dilatation of the cavities, by which the lungs are inflated, is counteracted in as far as regards the heart:— for the mediastinum, being connected firmly with the diaphragm, and the diaphragm contracting only upon its lateral parts, its efforts upon the mediastinum must pull the membranes closer about the heart, in proportion to the increase of capacity of the thorax, and to the tendency which the heart would otherwise have, in consequence of that increase, to suffer dilatation. This may serve as some explanation of the heavings of the chest, when, by violent exercise, or in any other way, the blood is sent into the right side of the heart in increased quantity; for while an increase of velocity in the circulation of the blood requires a proportional increase in the action of the lungs, the compression of the heart and vessels, when the diaphragm acts strongly upon the mediastinum and pericardium, makes us instinctively struggle to procure the necessary dilatation rather by the expansion of the ribs than by the action of the diaphragm. If the lungs are thus dilated by the expansion of the thorax, then the diaphragm does not need to be so violently contracted, and, consequently, the pericardium and mediastinum do not so strongly compress the heart, veins, and right sinus.

This mechanism in the thorax brings the great vessels in the breast more to a balance with those in the belly, and other parts of the body.

An increase of the velocity of the blood in circulation must be accompanied with a proportional increased action in the lungs, because this increase of the quantity or velocity of the blood passing through the heart, is an increase of its stimulus, which must be accompanied with a proportional increase of the power of action or irritability; the source of which is in the lungs, and which, through the medium of the blood, is bestowed upon the heart. Were not the heart thus invigorated to greater action, an increased flow of blood through it would exhaust its powers, and a load of blood be forced into its cavities, which it would be unable to propel forward; as happens in experiments upon the lungs of animals, when the artificial breathing is stopped *.

Upon examining the situation and connexion of the superior and inferior cava, it is evident that they are not so large, in proportion to the arteries, as the veins in other parts of the body are; and that the blood must consequently pass through them with

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* It is said, that the blood, as a local stimulus, could not produce that regularity which the heart has in health, nor that irregularity which we find in disease. But the blood affects the heart in two ways;—first, by stimulating it to exertion, in consequence of the mere distention of its cavities;—and, again, by bestowing upon it, in its circulation through the coronary vessels (as in every other part of the body), life and the principle of activity. When blood unventilated, unimpregnated with new properties (or deprived of that change, whatever it may be, which the lungs produce upon it), gets access to the coronary vessels, it more quickly dissipates the energy of the heart than if the heart were allowed to exhaust itself, deprived of all circulation. It is of consequence to observe the appearance of the blood circulating in the coronary vessels, in experiments upon the action of the heart in living animals. This is not a matter foreign to the present subject; it is impossible to account for the way in which the blood is found distributed in the system after death, without considering it.

greater force or celerity, since the diameter of the veins, compared with that of the arteries, must be the measurement of the comparative force with which the blood passes through them.

At the bottom of the jugular veins, and at the mouth of the axillary or subclavian veins *, we find valves placed, which defend them, as they enter the thorax, against the regurgitation of the blood from the chest into the upper extremities and head, when the contents of the chest may (in consequence of any irregular action peculiar to the respiratory organs, as coughing or sneezing) be under severer pressure than the veins in the extremities †. That it is not to prevent the back stroke of the auricle that these veins are guarded by valves, we may presume; since there are no valves guarding the pulmonic veins from the action of the

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* Are we to consider the dilatation in the great veins of the neck as a provision against congestion in the head from any irregularity in the circulation of the chest, and as admitting a kind of deposit here of that blood which would still more subject the head to the load of repelled blood during violent coughing, &c.? In violent fits of coughing, the contents of the chest are under violent compression during the convulsive expiration; but, preparatory to that convulsive expiration, and after it, the mastoid muscles and platysma muscle are in violent action as a muscle dilating the chest, the head being fixed; they must compress this dilated vein, which lies immediately under it; and as the blood in this vein cannot enter the head again, it is forced into the superior cava.—See what is further said of the action of the abdominal muscles.

† In dissecting subjects in which there are enlargements of the heart, or where palpitations of the veins of the neck have formed a symptom of this disease, and where the pericardium is found dilated, &c.—it is of consequence to examine the state of relaxation of the diaphragm, the valves of the veins in the neck, the valves in the heart, and the general relaxed state of the membranes in the thorax, as explaining the symptoms of the disease during life.

left auricle, and since there are no valves in the lower cava. This last circumstance suggests to us the probability, that in every irregular motion in the action of respiration, the compression upon the vessels is the same in the abdomen as in the thorax; for if there were a possibility of a greater compression in the thorax by any voluntary exertion of the body, or irregularity of respiration, the lower cava would have been defended likewise with valves. And it will appear, from a review of the action of the abdominal muscles and diaphragm, that the veins in the thorax and abdomen do in all actions suffer like degrees of compression. Let it be considered for a moment, what would be the consequence upon the viscera of the abdomen, if, during a fit of coughing, their vessels were liable to as violent distension as we sometimes see in those of the face. That the compression upon the vessels of the thorax, and upon those of the abdomen, is the same, will further appear from this consideration, that when the abdominal muscles act strongly, the diaphragm yields, which prevents the greater compression of the abdominal viscera. On the contrary, when the diaphragm reacts and resists, then the force resisting (viz. the diaphragm) being equal to the force of the abdominal muscles, it follows, that the portion of the cava which is in the thorax is as strictly compressed by the mediastinum as the cava in the lower belly is by the abdominal muscles. Again, if the diaphragm acting should be supposed to compress the vessels round the heart, it must be remembered, that its contraction pulls strongly upon its origin, or insertion, only according to the resistance which its action meets with: and as the mediastinum may almost be considered as the insertion of this muscle, if the abdominal muscles do not react, the mediastinum cannot be too strongly compressed, and the abdominal muscles, when they do react, compress the lower cava with an equivalent force.

If the pressure were not equal in the breast and in the belly, but greater in the breast, then would the blood be occasionally repelled from the breast, and accumulated in the abdomen*.

It comes next to be considered, what is the power which dilates the auricle; and what is the consequence of the action of the auricle upon the column of blood in the veins? The great use of the auricle is to prevent the action of the ventricle upon the circle of blood contained in the vessels from propelling the blood round upon the ventricle, even whilst yet in its state of contraction. For when the ventricle contracts, it throws forward into the beginnings or extremities of veins a quantity of blood, besides what dilates the arteries; and a portion of the column of blood in the veins nearest the heart is consequently driven forward and fills the auricle†. That the dilatation of the arteries is not sufficient to account for the quantity of blood sent out by the contraction of the ventricle, is apparent from the flow of blood being continued in the veins during the contraction of the heart and dilatation of the arteries:—and that quantity of blood which is more than sufficient to dilate the arteries, and continues to flow in the veins, would, it is evident, distend the sides of the veins, were not the auricle, at this time, relaxed so as to allow an easy exit from the veins of this addition to their column of blood. This free exit to the venal blood, in the direction of the axis of the veins, prevents an additional lateral pressure.

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* In violent coughing, straining, sneezing, &c. whenever, in short, the thoracic and abdominal muscles are exerted, stagnation is said to be produced in the veins near the thorax. This, it may be observed, can never be brought directly to the test of experiment, unless in the veins of the neck; because these actions cannot be produced when the breast of an animal is laid open. The opinion has arisen from seeing people coughing violently with the face turgid with blood; but this is caused by the difference of compression in the thorax, and in the head and arms, and does not prove that there is any difference of compression in the belly and in the breast. And the greater turgidity of the face than of the arms is probably occasioned, partly by the action of the muscles of the neck (chiefly by that of the platysma myoides, which covers the external jugular vein, and is in violent spasmodic-like contraction during violent coughing), and partly because any dilatation of the vessels of the head must be external only.

† In examining monsters, and in dissecting the more imperfect animals, the great principle which must keep the

It is perhaps more difficult to explain why there is not a regurgitation of the blood, or dilatation of the veins, upon the reaction of the auricle. For though the force and quantity of the blood sent from the ventricle be so much more than sufficient to keep the veins dilated to their stationary diameter as to dilate the auricle also, there is still to be accounted for that portion of the blood delivered by the ventricle, which was sufficient to fill the arteries, and which continues to be forced on during the contraction of the auricle, with which the contraction of the artery is synchronous.

The question comes simply to this, at what time, or by what power, does this quantity of blood, which

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blood in an uninterrupted circulation ought to be remembered, viz. the alternate action and relaxation of the muscular fibres of the arteries; their elastic power being only subservient in resisting, and in throwing the contraction of one set of muscular fibres upon that which is to follow, that they may be dilated, and again, in their turn, react. An artery cannot circulate the blood either in a monster or a worm without some part of the circle alternating with it in action and relaxation.

is sent out by the ventricle, and which is more than sufficient to dilate the auricle, and stimulate it to contraction, return to the ventricle? Does the blood, even during the contraction of the auricle, still force itself onward by the effort of the arteries to contract, not in opposition to the contracting auricle, but acting, in aid of the auricle, to distend the relaxed ventricle? Or does the quantity of blood, which is by the contraction of the arteries propelled into the veins, distend the veins through the whole body during the contraction of the auricle, and when the blood may be stopped from entering the heart? The first of these seems to be the truth;—because, by supposing the contraction of the arteries still to carry forward the column of blood in the veins so as to flow through the auricle into the relaxing ventricle, the whole quantity of blood sent out from the ventricle is accounted for without any pause or stop in the whole circulation *. This seems to agree the best with our observations on living animals: and it accounts for

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* From observations on the heart's motions in living animals, when influenced by artificial breathing, Mr. Hunter concludes, "That the auricles are only reservoirs, capable of holding a much larger quantity than is necessary for filling the ventricles at one time, in order that the ventricles may always have blood ready to fill them." This is the opinion which is carelessly adopted in all books in which any explanation is given of this. But it is perfectly clear, that since there is a quantity of blood sent out from the ventricles, sufficient to dilate the arteries as well as the auricle, there must, upon the relaxation of the ventricle and action of the auricle, be a quantity of blood equal to that which dilated the vessels returned into the ventricle, besides what is supplied by the auricle; and the contraction of the auricle cannot, from its own stores, sufficiently dilate the ventricle, without there being, in the next round of actions, a deficiency of blood sent by the auricle into the ventricle.

the lateral pressure of blood upon the sides of the veins being at all times equal. And if the combined power of the arteries cannot force a portion of the column of blood, equal to their contraction, into the ventricle during the contraction of the auricle, then not only must it be allowed that the contraction of the auricle is stronger than that of the arteries, but that it is so even when its whole side is as if opened by the relaxation of the ventricle. It is evident, then, that the relaxed ventricle is the only opposition to the flow of the blood from the veins into the heart during the contraction of the auricle. Were we to account for the quantity of blood sent out by the ventricle, by supposing a dilatation of the veins to take place, we must allow a stoppage, or retrograde movement, in the great veins, which is contrary to the facts every day before us; and besides, this supposed dilatation of the veins (which may be imperceptible, being so small a quantity of blood diffused over the whole body) must be accompanied by a greater compression upon the blood of the veins at one time than at another; which should be easily observed.

It may be well to consider, how very small any dilatation of the veins, occasioned by such an insufficient cause as is generally assigned, must be; and the investigation will at the same time take away from the support which might be derived to the above opinion from the observations of those who have seen even violent pulsation in the veins, and conceived it to be occasioned by the action of the ventricle, and to be synchronous with the pulsation of the arteries*.

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* Mr. Hunter says, "I think I have seen the difference of the projection so great, that it hardly could arise from that cause alone;" viz. the lateral dilatation of the accompanying arteries.—And he adds, "The large veins near the heart have a pulsation, which arises from the contraction

The pulsation in the arteries is occasioned by the whole quantity of blood sent through them, in the direction of their axis, lengthening them, in opposition to their elasticity, and causing them to form contortions or curves. This is well illustrated in the pulsation of the heart against the side; which is in fact the pulsation of the aorta, not of the heart, and is caused by the effort of the aorta to lengthen itself, and to form a more direct line, carrying the heart as on its point. It is illustrated also by the contortions of the arteries of living animals; as in the membranes of the chick in ovo, by the pulsating bud of an artery when tied in our operations:—and it gains additional proof from considering the very small dilatation which an artery must suffer in any one point touched by the finger, though the dilatation of the whole taken together is considerable. It is not, therefore, the degree of dilatation which we feel in the pulse, but the shock given to the column of blood by the action of the ventricle. Before adopting the opinion, then, that

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of the heart preventing the entrance of the blood at that time, and producing a stagnation. This I saw in a dog," &c. The inconsistency of this is evident. He finds a dilatation of the veins synchronous with the dilatation of the arteries, viz. by the contraction of the ventricle: and, again, when they should unload themselves of this blood which dilates them, they are precluded by the action of the heart preventing the entrance of the blood, and forming a stagnation. And, in opposition to both these observations, he says, in the same page, that in some fevers the arteries contract, and the veins dilate alternately. Having an unsettled wavering opinion, he makes observations in direct contradiction. All observations in experiments upon the dilatation of the vena cava near the heart, the effect of artificial breathing on the action of the heart, and stagnation of the blood by expiration, are inaccurate; for by the opening of the breast the whole actions in the thorax must be completely deranged.

the reaction of the arteries should perceptibly dilate the veins, or convey a pulsation to them, it must be remembered, that the veins, either during the contraction of the heart, or during that of the arteries, do not receive the impulse of the same quantity of blood which gives the pulsation to the arteries; but if they should be supposed to dilate during the contraction of the arteries, they receive only that which is spent in the dilatation of the arteries; and if they are supposed to be dilated during the contraction of the heart, then are they dilated by the blood sent from the ventricle, which remains after the dilatation both of the arteries and auricle. To all this must be added the very great difference of capacity of the veins and arteries;--we must consider that many veins of a greater size accompany a single artery in the extremities; and how immense the capacity of the veins is in many parts of the body; as the sinuses of the head, the great veins in the neck, abdomen, and pelvis. How little effect that quantity of blood which dilates an artery (in a degree imperceptible to the sight) should have, when thus dispersed in the greater capacity of those veins, which is triple, or even quadruple, that of their accompanying arteries, must be at once acknowledged.

But further, a pulsation, supposed to be transmitted to the veins, would differ from that given to the arteries, in this—The pulsation of the arteries is great near the heart, because their elastic resistance is great, and the force of the current of blood sent forth from the heart is propelled violently in a narrow channel: and the elastic resistance of those greater arteries throws the force of the blood forwards unexpended into the smaller arteries, which have a less degree of resisting elasticity, and a diameter (the caliber of their branches being taken collectively) infinitely greater than the trunks: — and as those branches have, as they recede from the heart, an additional muscular force in proportion to the loss of their elastic resistance, which muscular power is then in a state of relaxation, that portion of the blood which is expended upon the dilatation of the arteries, is bestowed upon their extremities chiefly; and the extreme arteries again react by their muscular power, in exact proportion to their degree of dilatation—and thus they become the most active agents in the circulation. But if the great arteries near the heart were dilatable in a great degree, it would retard the circulation; because the force of the ventricle would be expended upon their dilatation where there was no need for it, since the dilatation is a provision for an additional muscular power, to be exerted in accelerating the motion of the blood. We see, then, that the arteries dilate as they proceed; but they form a cone with its apex in the heart; that the blood must move more slowly onward in the extremities; and that it loses, in a proportional degree, its impulse from the heart. The effect of the contraction of the arteries upon the veins, differs from that of the heart upon the arteries, in this, that the effort of the heart is accumulated to a point, and the whole blood of the body is propelled through a narrow channel; that the contraction of the extremities of the arteries, on the other hand, although great, when taken in its combined effect, yet being diffused over the whole body, and the action upon the veins being through their innumerable extremities, and the quantity of blood returned by the veins, during the impulse of the heart, not being equal to that which passes through the aorta, the blood in its passage through the veins cannot have the same effect in causing a pulsation with the current of blood through the aorta.

Those who conceive that there is a pulsation in the veins, and who argue from what they have observed of the beating of the veins, or the leaping of the blood from them when punctured, as from an artery, besides overlooking the effect of the alternate action of the heart and arteries, do not seem to have considered what effect this great degree of action in the veins of the whole body would have, upon their insertion into the right side of the heart: for perceptibly to dilate the veins, would take a quantity of blood greater than is sufficient to dilate the auricle; while, by their account, this pulsation is occasioned by the same power which causes the pulsation of the arteries, viz. the ventricle. Now this is the same with saying, that the contraction of the right ventricle of the heart dilates the arteries, dilates the veins, and fills the auricle; and in this state the quantity of blood delivered from the heart is left, without accounting for the manner in which an equal quantity of blood with that which fills the arteries and veins returns to the ventricle from which it was propelled. When are the veins supposed in this case to be emptied? It must be during the contraction, not only of the auricle when the exit of the blood is more difficult, or, as the greatest supporters of this opinion say, is absolutely stopped; but also during the contraction of the arteries upon the other extremity of the veins, which probably produces a greater effect upon them than even the action of the heart, which is more remote.

The most essential difference between the veins and arteries consists in the different velocity of their blood. The quantity of blood under the active influence of the heart and arteries, at the same moment, is amazingly small, compared with that in the veins: but in any length of time, the quantity passing through the arteries will be equal to that passing through the veins; for the veins have the blood slowly moving in their large cavities, while in the arteries it is sent quickly through their narrow channels. The blood in the veins approaching the heart, is received as in a vortex, pushed in an instant through the right side of the heart, driven through the circulation of the lungs, has its properties invigorated, and, in an instant, is sent through the whole body, comes in contact with the parts with which it is to act, is again deposited in the veins, where for a time it lies inactive, or sluggishly moving through their dilated cavities. If it were not for this distribution, and if the heart and arteries could not draw supplies from the more inert mass of blood in the veins, our lives would be still more liable to every accident, and a trifling loss of blood would be fatal. It may be of importance to consider, as connected with the animal economy, from what proceeds, or to what tends, the increased quantity of blood in the dilated veins of old people, and whether it corresponds with the diminished velocity of the pulse, &c.

From the nature of the subject, this account may appear prolix or confused. In the apparent simplicity of the heart's motions, there must be many actions in unison with each other, while yet in description it is difficult to convey an idea of the accuracy with which every action is adapted to that which is to follow. But it may be useful, in concluding this subject, to give a short recapitulation of the mutual action of the heart and blood-vessels.

The contraction of the ventricle delivers into the artery a quantity of blood, which quickly pervades the rigid trunks, and is sent into the more pliant muscular extremities, which are then in relaxation. These arteries dilate through their whole length, but chiefly in their small branches. Besides the quantity of blood dilating those arteries, there is enough sent from the ventricle of the heart to continue the propulsion of the blood into the veins, which, displacing a proportional quantity from those veins which lie near the heart, propels it into the auricle, and dilates it. By this means the auricle is dilating during the contraction of the ventricle: again, upon the relaxation of the ventricle from its action, the flow of blood is continued into the veins by another power, viz. the contraction of the arteries. By this contraction, the quantity of blood sent out by the last pulsation, more than was sufficient to fill the auricle, is continued forward with great force; a force as great as that exerted by the auricle: it consequently enters the relaxed ventricle along with that blood which is sent in by the contracting auricle; and so a mass of blood, equal to that sent out by the pulsation of the heart, is sent again into the ventricle. The flow of the blood through the inosculating branches of the arteries and veins (which must be considered as the ultimate intention of the circulation) is slow and uniform, allowing a reciprocal action betwixt the fluids and solids; and is yet sent to the heart in such a manner, that the alternate action of the muscular power, the efficient cause of the circulation, is at one time allowed relaxation, and is at another stimulated to action.

See peculiarities in the Vessels of the Extremities, in that Part which contains the Dissections of the Thigh, &c.

FURTHER APPEARANCES OF DISEASE IN THE CIRCULATING SYSTEM.

Although, during life, the heart seems the most frequent seat of disease, the most distressing symptoms, and all the feelings of misery and oppression, seeming to be concentrated there; yet organic diseases, or such derangement of the natural structure as comes under examination in the dead body, are far from being common. This is to be ascribed to the more lively sensibility of the heart; and its strict dependence upon the reciprocal actions of the whole system.

so that while the feeling of disease in the heart is common almost to a necessity in every more universal disease, its organic derangements are comparatively few.

OF DISEASE IN THE HEART.

I have never seen inflammation of the heart, unless from wound or the communication of disease from the bones or the lungs. Nor have I seen abscess in the substance of the heart, far less mortification. The heart has burst and suddenly killed the person, but this is very rare: blood has been found in the pericardium where no orifice could be discovered in the heart or vessels. There are no two appearances so common, and so much connected, as a bloated, soft, and watery state of the body, and a soft, flabby, and enlarged heart—where the heart seems in sympathy with the languid and dissolved state of the body. Such a state of the heart may be expected when the complexion has been of a pale and leaden colour, with languor of all the bodily functions, and a gradual loss of strength; the pulse becoming weak and small, accompanied with frequent faintings, and sense of weight and oppression at the heart. The consequence of a disordered state of the functions of the lungs upon the heart, and the loss of that reciprocal connexion which is kept up during health, must often give rise to symptoms which are ascribed indiscriminately to the heart. When the breathing is gradually stopped, in experiments with artificial breathing upon living animals, the heart becomes languid in its actions, and swells up with blood which it is unable to propel. The blood undergoes its changes in the lungs imperfectly, and in this state is received into the circulation, and is sent into intimate union with the whole body. The effect of this contaminated blood is immediately perceptible upon the heart,—not that it is less capable of irritating the heart to action, but that it is incapable of bestowing the principle of action upon it, through the medium of its circulation in the coronary vessels. Then the irritability of the heart is destroyed, the blood is pushed into the heart by those powers which are not so immediately affected by the loss of the most essential properties of the blood, and the auricles and ventricles are overpowered with blood. This is an experiment which we must consider as imperfect, but it may lead us by analogy to the explanation of nearly the same phenomena in disease. When the powers of the system fail, when the action that must take place betwixt the fluids and solids is in any way interrupted, then is the delicate sensibility of every organ to its peculiar stimulus and action diminished. And when such an effect as this is produced upon the heart (and it must take place in the last stages of many debilitating and tedious diseases), then does this state of the heart almost infallibly present itself upon dissection; the heart is enlarged, stuffed with blood, and flaccid in its texture, the aqua pericardii is in considerable quantity—and often the whole body is tabid. In this case, where the distension of the heart is habitual, the aorta is found remarkably small, being allowed gradually to contract its diameter, to suit the weak contractions of the heart; but still the artery is not (as we should expect from this explanation) thick, as if its coats had contracted, but remarkably thin and delicate. Nor must we suppose, that the state of the artery is in contrast with that of the heart—the heart being diseased, while the artery is in a state of healthy contraction; for the artery suffers the same loss of power with the heart. The difference is, that much blood is sent in upon the heart, which it is unable to push forward, and its sides are thin and dilated, while in the arteries there is a deficiency of blood.—Were it possible to conceive, that the heart should regain its healthy powers while the artery remained in this state, the artery would be too weak for the powers of the heart. It must be remembered, that though the muscular power of the artery is weakened, yet a permanent dilatation will not be produced whilst its elasticity remains. for the arteries in their contraction have not to combat with the heart, during its action; therefore the arteries will not be permanently dilated by the contraction of the heart, unless when, as in their diseased state in aneurism, they are incapable of contracting again by their elasticity: and whilst the contractibility of the arteries remains greater than that of the veins, they will not be seen dilated in the dead body.

We find, that when the heart is distended with blood, the right side of the heart is the most distended. This may be explained from the consideration of the difference betwixt the two circulations. The circulation through the body is the most extensive; and having greater power, must, upon the ceasing of the heart's motion, continue for a little to pour the blood into the right auricle and ventricle, while the left side of the heart has neither the same quantity of blood in the circulation of the pulmonary vessels, nor are these vessels so extensive, nor do they possess so great an elasticity, as the aortic system, and the extended veins of the body. Neither will the thick and strong sides of the left cavities of the heart allow of distension so easily as the right. The blood in the great vessels of the body is forced in upon the right side of the heart, when, from failure of its powers, it is incapable of propelling it into the lungs, and from thence into the left side of the heart.

In considering palpitations of the heart, we must remember, that the natural pulsation of the heart against the ribs is not the dilatation or contraction of the heart itself, but the effect of its contraction upon the arch of the aorta, as explained by Dr. Hunter. But in violent palpitations of the heart, where it is enlarged, and weakened in its powers, and the aorta is small and insignificant, the palpitations have been sometimes observed not to be synchronous with the pulse at the wrist, as the natural pulsations of the heart are. In such cases, it may perhaps be the auricle which is affected with irregular motions when it is violently distended with blood; and the ventricles likewise being enlarged, the apex of the heart is forced against the ribs. From what I have seen, however, of the pulsation of the veins of the neck, I would say, that it is impossible to determine whether the motion is at the same instant with the arteries or not.

Palpitations or pulsations of the veins in the neck, and even of those in the arms, sometimes accompany enlargement and disease of the heart. To form a just conception of the cause of this pulsation, we must consider the peculiarities in the situation of the vessels near the heart. The pericardium, investing the ventricle and auricle, suffers little dilatation by the action of the heart:—its greatest dilatation is during the diastole of the ventricles; because the space filled by the dilated ventricles is somewhat greater than that of the dilated auricles; yet the difference must be small. The mediastinum involving the pericardium sends its membranes round the great veins which reach upwards from the auricle, and strengthens them. When, therefore, the veins in the thorax are dilated, and the whole heart enlarged, there must be a distension of these membranes likewise; and the disease is not confined strictly to the vascular system here, but even the diaphragm and involving membranes will be found relaxed, and the cavities dropsical. By the dilatation of the veins the action of their valves is affected; they become too small for the diameter of the vessel, and the blood passes them. But the auricular valves, or those properly belonging to the ventricles, are not affected by the dilatation of the veins; their relaxation must depend upon the elongation of their muscular attachments to the inside of the ventricle. To cause a pulsation to be felt in the veins without the thorax, a loss of power, both in the valves of the veins and in the valves of the heart, must have taken place:—because, if the conclusion be right, though the valves of the veins at the lower part should have lost their power, yet while the extended circulating powers return the blood with due vigour to the heart, the contraction of the auricle will not be felt retrograde upon the column of blood in the veins: but if the heart and veins be dilated, and the tricuspid valve have lost its action, so as to allow the blood to recede again from the ventricle into the auricle during the contraction of the ventricle (the contraction of the latter being greater than the first), the pulsation will be obscurely felt in the veins of the neck, beating synchronous with the arteries through the body.

In examining these diseases of the heart, therefore, in dissection, or in considering the symptoms during life, much is left to be decided upon by reasoning from the symptoms. It may be required to decide, whether this pulsation be communicated to the enlarged veins by contiguous arteries, or by a pulsation from the auricle, or whether it be communicated from the ventricle, through the auricle and the column of blood in the veins? or whether, again, the tremulous trilling feeling in the veins may not be produced by the action of both auricle and ventricle? In these diseases, the pulse is so irregular, and quick, and feeble, that it will be difficult to say, whether the beating of the veins is simultaneous with that of the arteries (and consequently of the ventricle). In dissection, again, we have to examine the dilated state of the veins near the heart, and the state of their valves; the degree of relaxation over the whole membranes of the chest; the state of the auricle; the relaxation of the ventricles, of the columnæ carneæ, and of the valves of the heart.

Dilatations of the cavities of the heart are improperly called aneurisms; but there have been cases which seem to have truly deserved the name, where the ventricles of the heart have at a point been dilated into a pouch filled with coagulated blood.

OF DISEASED APPEARANCES OBSERVABLE UPON OPENING THE HEART.—To examine the diseases in the cavities of the heart, it is evident, that it must be dissected with as much care as for the demonstration of its simple anatomy. There is one circumstance, however, which may be remembered, that it may be required to examine coagula or polypi of the heart, which may reach from the ventricles into the great vessels, the aorta, or the pulmonary artery. To demonstrate these through their whole course, the cavities of the heart may either be laid open while the heart is in the body, or the great arteries slit up, and the coagula withdrawn from them, and kept attached to the heart. And in this case, the coagula being strong, and minutely ramifying through the lungs or aorta, form a beautiful demonstration, when the cavities of the heart are opened, and their roots shown attached to the irregular inside of the ventricle, and the intricate interlacements of the cordæ tendineæ. That these polypi formed from the blood are for the most part formed after death, there can be little doubt; but still there are circumstances to be attended to which have induced many to believe that they are formed during life. They are found in layers, which argues a successive formation; or they are attached to the sides of the arteries where their coats are diseased; and their attachment does not appear to be accidental or owing to the simple coagulation of the blood. In many instances, however, where these coagula are remarkably firm, and such as we should suppose were formed during life, we find, upon examination, that the extremity, which is loose, lies in a direction contrary to the course of the blood; a direction in which we must be sensible it could not have remained during life; for it must have been driven in the direction of the current of blood, while the root was held nearer the heart. There must be coagula formed in dilated arteries; and to distinguish betwixt those which have been formed during life, and impacted in layers filling the dilated bag, and those which have been formed after death, is often impossible. How, then, in the case of the coagula prolonged into the great vessels (which alone are called polypi), can we expect to distinguish what has been formed in the last feeble actions of the heart, from those which have been formed after death? Were they ever formed in the vigour of the system, we should have had cases of some smaller part being torn from the trunk or stem of the polypus by the force of the circulation, and driven into some of the branches of arteries, so as effectually to interrupt the circulation of some important part. No such thing happens, and the conclusion on the whole is, that they must be never looked to for the explanation of symptoms

In the ANNULUS VENOSUS I have found a stricture so narrow as just to admit the finger.

OF THE VALVES AS SUBJECT TO DISEASE.—The muscular coat of the aorta is not continuous with the muscular fibres of the heart; probably because their actions are alternate: but the inner coats of the arteries are continuous with the lining membrane of the heart, and the membranous valves in the heart: the whole inner membrane of the heart, and even the tendons of the tricuspid and mitral valves, are evidently subject to the same disease with the arteries. We see them partly of their natural colour, partly variegated with a more opaque whiteness, and increased in thickness.

The semilunar valves of the aorta and pulmonary artery will be frequently found thickened and more opaque than usual. They are found ossified, too, or with a deposition of earthy matter. Upon opening the surface, there will be seen several little distinct ves. The easy play of these valves must be much impeded by this state of disease: they must become stiff and rigid instead of being pliant, and floating easily with the tide of blood. The extreme tenuity of these valves, and the netted appearance of their edges, would incline us to believe, that this also were a diseased state. But these deficiences in the valves do not allow the blood to pass them; they are only upon the edges, where the valves are in contact when in action. The appearance being as common in children as in adults, teaches us, that these holes are not worn by attrition. It does not appear that there is an instance of any part of an animal body being liable to such a waste: it is endowed with powers to counteract it. These valves have been found ruptured; and this we should naturally attribute to the force of the retrograde blood, and thence argue a great force in the contraction of the arteries. It is not impossible, however, that they might, when diseased, have been ruptured by the violence of the heart's contraction occasioning a great degree of dilatation in the root of the aorta, which they (being unelastic) might be unable to bear.

The mitral and tricuspid valves are subject to the same diseased thickening, and to have concretions formed in them. Their small tendons, too, if narrowly observed, will be found partaking in the disease

There is yet one disease on which I wish to be more particular: the Angina Pectoris.

CASE OF ANGINA PECTORIS.

Mr. G. A. is a tall and corpulent man of 50 years of age, and though addicted to no excess in drinking, is in the habit of eating heartily where his palate is indulged He has on his face, probably in consequence of this habit, an eruption of those florid pimples which so commonly arise from frequent surfeit. He is a bachelor, of regular habits, and uniformly takes his walk when the weather is favourable. He has been for 15 years subject to dyspeptic complaints, and they have increased for the last two or three years.

About the end of September 1793, he felt a piercing pain strike from the under and fore part of his chest to his shoulders, and then along the arms extending to the points of the fingers; this was accompanied with a very unpleasant and painful sensation of the stomach, and great depression of the mind. It continued a considerable time, and then gradually left him.

After this, similar attacks (as far as he recollects) frequently recurred, and of late he has many every day. They come at irregular intervals, and are of uncertain duration; but they are often brought on by fatigue. The pain in these attacks he finds alleviated, and the paroxysm, as he conceives, brought sooner to an end, by standing erect with his hands stretched above his head. He is also relieved by vomiting a sour acrid phlegm, which he frequently brings up in mouthfuls after meals or bodily exertion. About three weeks ago, the pain became so unremitting and excruciating, that he was obliged to stand for forty-eight hours before it abated. He stood indeed so long, that he brought on œdema of the lower extremities; at that time he took large doses of opium without any benefit.

He is troubled with flatulence and a costive belly, his pulse is natural, and continues to be so during his paroxysm; his appetite is not impaired, but he suffers so much after eating a hearty meal, that for some time he has lived abstemiously. He is neither emaciated, nor has he suffered diminution of strength; his spirits are equal, and he is constitutionally so cheerful, that wonderfully soon after his sufferings have ceased, he forgets them. He has submitted to a mercurial course, and has tried various tonic medicines. He thinks the attacks are less violent, and not so frequent when his bowels are loose, and he has had more relief from small doses of soda phosphorata than from any thing else. This is probably by lessening the exertion at stool, for costiveness always brings on a paroxysm.

May 1, 1801.—Soon after this report was drawn up, this gentleman, disappointed by our unsuccessful attempts, left off medicines entirely. The use of issues and purgative medicines was recommended, but he declined trying further remedies. We may further observe, respecting his paroxysms, that he was generally so well in the forenoon, that he often walked many miles, and this he could do without difficulty, provided there was no acclivity in the way; but after dinner he could not walk a hundred yards without bringing on a fit of his disease. Now, as he rather gained in appearance of health, he became hardened to his sufferings, and paid little regard to the rules which were laid down for him.

One morning when Dr. Cheyne called upon him, he congratulated him upon his looking so well. He had gone up stairs rather hurriedly, and on entering the room, begged that he might be excused for a little. His sufferings he said were agonizing after the exertion he had made in ascending the stair-case, but that he should soon be well. He raised his arms, and leaning on the chimney-piece, recovered in two or three minutes, and entered cheerfully into conversation. He regretted much that he could not dine with a friend upon some particular occasion, for now, he said, the slightest exertion after dinner brought on a paroxysm, and that he found his only safety in keeping his arm-chair. He added, "my friends, misled by my looks, are always telling me that my complaints are imaginary; but my sufferings are past description, and must arise from some uncommon cause; and of this I am so well convinced, that I wish my body to be opened when I die. I confess that I had a prejudice against this, but I have overcome it, from the hope that it may be useful in alleviating those dreadful sufferings in another."

Soon after this conversation, this gentleman walked several miles, and returned home in very good spirits: he ate a hearty dinner, was cheerful all the evening, and, on going to bed, expressed great thankfulness for having escaped an attack after coming from his walk.

This morning when his servant went to call him to breakfast he was lying in bed dead. As he was quite cold, it is probable that he died early in the night.

May 2.—DISSECTION.——When laid upon the table, the chest of this body was large and protuberant, and its appearance such as should have indicated good health. In the dissection, the quantity of fat accumulated about the body was observed to be very considerable, though the limbs were spare, as indeed is common in men of his age. When the sternum was lifted, the cellular membrane of the anterior mediastinum was so much loaded with fat, as to obscure the heart and pericardium. When the pericardium was brought into view, however, it appeared beautifully transparent, not thin, nor very delicate, nor as if dried, but natural in every respect, except this very peculiar diaphanous appearance.

The heart being exposed, its colour was very pale and somewhat leaden, unlike the fresh and fleshy colour which the heart usually presents. It was also much covered with fat. In the cavities of the heart there was nothing particularly remarkable, further than that the mitral valves, and the beginning of the aorta were thickened, and had in them specks of ossification. The semilunar valves were also thickened irregularly, but not so much as to impede their perfect action. On cutting through the substance of the heart, however, the knife grated on the ossifications of the coronary arteries. Upon a more particular examination, a complete circle of ossification was observed betwixt the coats of the coronary arteries. These concretions or ossification pervaded the coronaries to the extent of some inches, which was the more remarkable, as the greater vessels which in general precede the smaller ones in this diseased state were but very little affected.

In the abdomen there were no marks of disease.

The case which I have here faithfully detailed, in all its circumstances very accurately resembles many others which have been laid before the public; and it is this very conformity with cases related by physicians deservedly the most eminent, which makes me venture upon some general remarks relative to this disease.

In the angina pectoris, the morbid appearances which, on dissection, most frequently occur, are the unnatural, or at least great accumulation of fat, and the ossification of the coronary arteries. Whether the accumulation of fat be a cause of the symptoms or the mere consequence of the disease, may be questioned. But as fat thus accumulated in other instances gives rise to no symptoms like those which are peculiar to the angina pectoris; and as, in some cases, the patient has begun to be emaciated and dropsical while the disease continues, we must rest our explanation of the cause of these symptoms on the ossification of the coronary arteries.

Physicians in speculating concerning the causes of the heart's motion, have too often confined their attention to some one of the many connections or sympathies by which the union of the heart with the general economy is accomplished, so as to form one whole. Some have looked to the connection of the brain and heart, as explaining the phenomena of the heart's motion; others have tied and irritated the nerves of the neck; others again have observed the heart's sympathy with the lungs, or have thought of the compression of the nerves by the motion of respiration; and lastly, some have expected a solution of the difficulty from the circulation of the blood in the coronary vessels. In deliberately contemplating the phenomena of the circulation, we must not overlook any of the connections of the heart, yet there are views which must take the lead in discussion, and especially in explaining the symptoms of disease. Although there be a strict sympathy betwixt the brain and heart, the heart and lungs, the heart and stomach, the heart and diaphragm; although the nerves, being pricked or compressed, accelerate or retard the heart's motion, and show that they are the medium of these sympathies; yet the immediate dependance of the heart is on the circulation of the blood for the support of its action, and for the continuance of its sympathies and connections. Whatever therefore interrupts, retards, or accelerates the motion of the blood through the coronary circulation, must affect the action of the heart itself; and as we see, that in most diseases, and in almost every affection of the body or of the mind the heart is influenced, so when the heart is itself the centre of disease, the symptoms are unusually severe, the attacks irregular, and the depression of mind most remarkable. There is an anguish made up of bodily and mental suffering which attends no other disease.

Although the blood circulates within the cavities of the heart, yet this circulation bestows no nourishment, and supplies not the muscular energy to the heart. For this purpose it is necessary that the blood should be carried into intimate union with the fibres of the heart through the coronary system. This may teach us the importance of attending to the ossification of these vessels in the investigation of the disease now under review. The ossification of the coronary arteries must destroy their power of action; they can neither dilate by the impulse of the heart; nor contract by their own muscular power in the same extent as formerly. In the case before us, there must have been very little, if any, action in the coronary arteries.

While the circulation proceeds with perfect uniformity, this state of the coronary vessels will be attended with no bad effect; but when the body is active, and the circulation is accelerated, and the blood returns more rapidly, and in greater quantity, to the heart, then must the paroxysm commence; for in proportion to the velocity of the blood's return towards the centre of the system the heart requires to be invigorated to greater action, and this is performed solely through the circulation in the coronary vessels. In this diseased state, however, they are incapable of increased action, and hence arises the pain and anxiety, and at last the total interruption to the circulation.

A SYSTEM

OF

DISSECTIONS.

PART IV.

ANATOMY AND DISEASES

OF THE

PELVIS.

DISSECTION OF THE PERINEUM,

Or of the Parts which are implicated in the Operation of Lithotomy, and in the Diseases of the Urinary Passages and Rectum.

PREVIOUS to the dissection of the perineal muscles, the arteries of the pelvis and of the lower extremities may be injected, that the branches of the pudic artery, and their connexion with those muscles, may be understood. The cavernous bodies of the penis and urethra should also be injected, and the subject placed upon the table, as the patient is held for the operation of lithotomy.

FIRST STAGE OF THE DISSECTION.

GENERAL VIEW OF THE PARTS TO BE LAID OPEN IN THE FIRST STAGE OF THE DISSECTION.—In this dissection, as the muscles and delicate arteries to be demonstrated lie deep amongst much loose elastic cellular substance, it is of some consequence to mark the depth and level of the parts. Because, although at first the student is circumspect, dissecting with caution, yet, gaining courage as he proceeds, and finding that he is only separating the cellular membrane, he plunges with more determined strokes of his knife, till at last he, with much disappointment, finds the external sphincter of the anus, or the transversalis muscle, cut away, and the demonstration destroyed: like those surgeons who, being strongly impressed with the idea that deliberation is the characteristic mark of their ability, commence their operation with an affected gravity of countenance and tedious cruelty; while in the important stage all is indiscreet hurry and confusion. In both cases the celerity and success depend upon the knowledge of the points in which caution is required.

The rectum having been ordered to be cleaned, a little baked hair may be introduced into the extremity of the gut, which will keep the anus gently protruding during the dissection; or a cork with a loop attached to it being introduced, and the mouth of the gut tied upon it, the dissection will be much facilitated, and the demonstration assisted, in consequence of the complete management we have of the gut; for we shall thus be able to turn it in every direction, so as to show its connexions.

The reader may here consult the Appendix, under the head Muscles of Perineum.

The place of the ERECTOR PENIS being evident, since it rests upon the ramus pubis and crus penis, it cannot be destroyed, and should be our first object in the dissection, as serving, in some measure, for a guide in the dissection of all the other muscles. The next point in the dissection is the ACCELERATOR URINÆ: its place we cannot fail to find, as it surrounds the lower part of the spongy body of the urethra.

In dissecting the EXTERNAL SPHINCTER ANI we have to recollect, that it consists of loose fibres encircling the mouth of the gut, and lies immediately under the skin. This muscle is, however, frequently missed in dissection, and it is indeed difficult to show it neatly.

A sure guide in the dissection of all these muscles, but chiefly of the TRANSVERSALIS PERINEI, is the tuberosity of the ischium; for the transversalis perinei, taking its origin from the tough tendinous-like membrane of the os ischium, runs directly across to the general point of union, lying about two inches deep in the elastic fat, which fills the space betwixt the anus and os pubis. By carrying the knife in the course of this muscle, it will not be unwarily cut across; its fibres being, in this manner, much more distinguished, and extricated from the surrounding cellular substance.

RECAPITULATION OF THE ANATOMY.

ERECTOR PENIS. A neat and delicate muscle arising from the os ischium; stretches its muscular fibres over the lower part of the crus penis; and spreading its expanded tendon, gradually coalesces with the sheath of the crus penis.

ACCELERATOR URINÆ, properly, EJACULATOR SEMINIS. From a middle line, as from a common origin, the fibres, diverging, run obliquely upwards on either side, embracing the bulb and lower part of the corpus cavernosum urethræ with a coat of muscular fibres; which, collecting into distinct tendinous slips, are inserted into the crura penis. Perhaps, considering its use, it were better to say, that, taking its origin from the body of the penis, it embraces and surrounds the lower part of the corpus spongiosum urethræ.

SPHINCTER ANI. The fibres of this muscle run in circles round the mouth of the gut; it can scarcely be said to have an origin or insertion. It takes hold of the os coccygis behind, and is attached to the accelerator urinæ before: more intimately and immediately embracing the lower portion of the gut, are the stronger fibres of the INTERNAL SPHINCTER.

TRANSVERSALIS PERINEI arises from the tuberosity of the ischium, is inserted into the central point of union, where the sphincter ani touches the accelerator urinæ.

TRANSVERSALIS PERINEI ALTER. This slip had better been called *obliquus*, for it is a small slip of muscle, which, from the same origin with the last, ascends to the side of the bulb and ejaculator seminis.

OF THE BLOOD-VESSELS IN THIS STAGE OF THE DISSECTION.

All the ARTERIES seen in this stage of the dissection are branches of the pudic artery. The pudic is sometimes named the EXTERNAL HÆMORRHOIDAL ARTERY; but,

We find the EXTERNAL HÆMORRHOIDAL ARTERY branching upon the extremity of the rectum, and enveloped in the muscular fibres, surrounds the anus.

The artery, which is prolonged by the side of the bulb of the urethra, and gives off twigs over the erector penis and crus penis, is a superficial branch of the pudic artery.

The TRANSVERSALIS PERINEI is a branch from the last artery, distributed in the cellular membrane, and to the sphincter ani.

The place of this artery is often supplied by several irregular branches.

Feeling deep on the inside of the tuber ischii, we may feel the trunk of the pudic if it be injected with wax.

The VEINS which are seen in this dissection are the pudic or inferior hæmorrhoidal veins, and accompany the arteries.

The NERVES which appear in the course of this dissection are the pudic nerves, coming from the second and third sacral nerves. They run sometimes over the transversalis perinei muscle; more frequently below it; sometimes they come out in one branch, sometimes in several twigs. But the veins and nerves are of less consequence to be studied than the muscles and arteries.

SECOND STAGE OF THE DISSECTION.

We may now take away the transversalis perinei muscle, and expose the deep and strong transverse muscle, which is more important to the lithotomist than all the others. In the course of the dissection, we have to observe the connexions of the LEVATOR ANI: it will be seen coming down from the neck of the bladder and triangular ligament of the urethra, and from the fibres of the sphincter vesicæ; and in stronger faciculi from the sides of the pelvis, converging to the anus, and mixing its fibres with those of the internal sphincter.

Proceeding with the dissection, the muscles of the perineum and the ejaculator seminis are to be taken away and the deep parts exposed. If the arteries be injected, we have to observe these

ARTERIES.

1. *Arteria Pudica Communis*, lying by the side of the ischium. 2. Irregular branches to the muscles and

ligaments. 3. *Perinei transversalis*, coming out into the cellular membrane. 4. *Arteria Communis Penis*, being the continued trunk, and this we may find dividing into, 5. A branch entering the bulb. 6. An artery which passes deep into the penis, being the *Profunda Propria*. And 7. the *Dorsalis Penis*.

Now, attending to the urethra and its connexions, we have to dissect round the bulb of the urethra, and observe the manner in which it hangs, as it were from the urethra. In tracing the urethra back from this place towards the neck of the bladder, we find what is called membranous part of the urethra, in dissecting which, we have to observe, what has been called the triangular ligament of the urethra; it will appear as of a middle nature, betwixt cellular membrane and tendon, surrounding the urethra, and connecting it and the prostate gland with the arch of the os pubis. It gives strength to the membranous part of the urethra; and being perforated by numerous veins coming from the penis, it has been described as cavernous.

In dissecting this part, it will be well to put a bougie into the urethra. We now lay bare the PROSTATE GLAND, observing always, the thickness of the cellular membrane and the depth of the parts; their relation to the arch of the os pubis, and to the rectum, through which alone we can examine them in the living body.

While these parts are exposed before us, there are many observations which ought to crowd to the recollection.

INFERENCES DRAWN FROM THESE SEVERAL VIEWS OF THE PARTS.

OF THE ACTION OF THE PERINEAL MUSCLES.—There is no combination of muscles more curious, or more deserving of our attention, than that of the muscles of the penis and rectum; whether we consider the importance of the organs to which they are subservient, or the diseases with which they are connected:—yet both the natural action of those muscles, and their action and sympathies in the morbid state of the parts, have been much neglected; and the uses or actions attributed to them are surely very far from the truth.

OF THE ERECTOR PENIS (*Ischio-cavernosi*, Winslow).—Is it not more natural to conceive that the use of this muscle is to brace the crura penis to the bone, than to adopt that explanation of its action which has gained it its present name? Can we conceive any mechanism so well adapted to give firmness and occasional strength to the hold which the root of the penis must have upon the bone, as that of a muscle partaking of the same stimulus, inert when the penis is flaccid, and roused to action in proportion to the excitement of the penis? To suppose it assisting the dilatation of the penis, by forcing the blood forward from the crura, is to attribute to it an action which would totally prevent erection, and not give firmness: the blood being excluded from the crura, could have no hold upon the os pubis. And the idea of its holding down the penis is (in spite of authority) ridiculous; since the pubes or adipose membrane betwixt the dorsum penis and os pubis, prevent further elevation, and render such an action in this muscle unnecessary.

EJACULATOR SEMINIS (*Bulbo-cavernosi*, Winslow).—To understand the action of this muscle, we must recollect the relations of the bulb and lower portion of the cavernous body of the urethra upon which it acts. The CORPUS CAVERNOSUM URETHRÆ is a spongy body, surrounding the urethra from its membranous part under the arch of the os pubis to the glans. The GLANS is the enlargement of this body towards the extremity of the penis, whilst its lower part in the perineum is also enlarged to form the bulb.

Within this lower part the canal of the urethra is dilatable into what has been called the SINUS URETHRÆ. Now this is strictly the operative part of the penis, and is raised upon the firmer support of the body of the penis, which alone, by its crura, has a firm hold of the os pubis. When the glans is excited, the whole parts of generation are brought into action:—the vesiculæ seminales more gradually empty themselves into the urethra; when the accelerator, being drawn into action, propels their contents forward by successive pulsations. It may be observed, too, that this action upon the bulb, though partial, affects the whole extent of the cavernous body of the urethra, and has the effect of contracting and making rigid that canal, so as to increase the force of the emission. This muscle can have no power of accelerating the urine, though it may throw out the last drops which lodge in the sinus*.

The erector and accelerator muscles are the only ones which can be conceived to have an independent action; and the accelerator is very strictly connected with the transversalis and sphincter ani. In that action of the accelerator which has been noticed, the sphincter ani, the transversalis perinei, and the levator ani, have a simultaneous action. The two first retain and steady the bulb of the urethra against the action of the accelerator; whilst the LEVATOR ANI, and muscular fibres about the neck of the bladder, compress the vesiculæ, and, constricting the urethra, prevent a retrograde movement of the semen.

DISEASED ACTION IN THESE PARTS AFFECTING THE DISCHARGE OF SEMEN.—1. The thing most necessary to be considered in the treatment of the diseases of the seminal organs, is the force of imagination on the passion, since, of those who seek relief from impotency, many are suffering from the idea of imperfection, rather than actual disease. It may be sufficient to hint, that absolute conviction of success must precede the accomplishment, and that such an admiration of the object as would make her more than woman, makes a man less than himself.

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* In the Edinburgh Medical Journal, a gentleman has committed a blunder so gross and palpable, in regard to the action of this muscle, in criticising a part of my work on surgery, that I think it right to leave him to his second thoughts.

2. An increased secretion from the vesiculæ seminales, or prostate gland, is frequently a cause of terror to patients, when there really is no diseased secretion of the semen.

3. There are instances of the retention of the semen. Disease of the canal near the mouths of the seminal ducts, is apt to produce a retention of the semen. Sometimes it is passed slowly, and only as the erection subsides; sometimes it is thrown back into the bladder, and is discharged with the urine, which, for a time, it impedes. Strictures in the urethra do not produce this effect, unless they are very narrow. Petit, in the Academie de Chirurgie, gives in instances in which he cured the stricture and this complaint by incision. 3. There is a more singular case by M. de la Peyronie, of a small tumour on the mouth of the ducts, which threw the semen back into the bladder, instead of passing it forward into the sinus of the urethra. 4. Much the same symptoms, I believe, are the consequence of ulcers having partially destroyed the accelerator muscle, when the power of expelling the semen from the sinus urethræ is lost. 5. There are, I think, more than one instance given of impotence, from too early a discharge, attributed to an enlargement and laxity of the seminal vessels. See Bonetus, lib. iii. sect. xxxi. ob. ii. & ob. i. De involuntaro seminis fluxu. We disregard all that is said on this subjeet by Bonetus.

6. In that affection of these parts which is consi-

dered as SEMINAL WEAKNESS, an attention to their action and importance in the economy will, perhaps, explain the nature of the disease. I should conceive, that the vesiculæ seminales receive the semen, not strictly as reservoirs; but that in these vessels it may be mingled with their secretion, so as to form, when diluted, a quantity of fluid fitted to be acted upon by the muscles of generation. Were the semen poured only from the vasa deferentia, there would be too small a quantity of fluid to be acted upon; nor would there be the same chance, nay, scarcely the possibility, of impregnation. We know, that the prolific power of the semen is not lessened by dilution; and indeed we are assured, that by the violent excitements of the parts, the prostate gland and all the mucus glands of the urethra contribute their secretions. By dwelling upon this, it is meant to point out the distinction betwixt those affections of the parts which are considered as seminal weakness, and any real affection of the testicle. The effect of inflammations of these parts, weakness, and loss of tone, accompanied by the discharge from the urethra, or gleets, or, perhaps, diseased secretion of the vesiculæ or prostate glands, will produce an increased secretion, a permanent or temporary laxity and debility of the secreting parts; and their contents being accumulated, will be thrown out in straining at stool, or in the expulsion of the last drops of urine, without implying any peculiar affection of the secretion of the testicle, or any more general debility of the system. 7. We must remember, however, that the seminal weakness spoken of frequently has no relation to the vesiculæ or prostate, but in a discharge from stricture and low chronic inflammation of the urethra. If there be any disease properly meant by the term, it is the frequent and uncontroulable discharge of semen. This is a complaint which gives great uneasiness; it proceeds from too much irritability in the parts, and is cured by the use of a bougie and strengthening medicine.

8. OF THE ACTION OF THE EJACULATOR SEMINIS IN CASE OF STRICTURE OF URETHRA.—In reviewing books on this subject, there is so much assumed, so much addressed to the ignorant for selfish purposes, that, to avoid speaking intemperately of them, it is necessary to avoid the discussion. But the following facts I must press upon the observation of the young surgeon, which I hope will enable him to arrive at the truth. No obstruction in a canal surrounded by muscles, is at any time entirely mechanical. Turn to what is said of suffocation for example; there the difficult breathing proceeds from the spasm of the glottis, and the cause of death is most generally the effusion in the lungs: here in the urethra, stricture or obstruction of any kind has its effect in disordering the consent which must exist betwixt the muscular fibres of the bladder and the urethra. I beg that it may be remembered, that when the detrusor urinæ acts, the muscles surrounding the neck of the bladder and urethra must be relaxed, or at least free of any tendency to activity, before the urine can be discharged; and that, if there is disease in the urethra, or disorder in the bladder, the urine will not flow, though the inclination to make it be strong. But, without removing an obstruction, if by rubbing the perineum, or by introducing a bougie, or dashing cold water, a change shall be produced, and the usual relaxation of the muscular parts of the canal, and the natural sympathy be resumed, the urine will flow.

When a stricture will not give way to a bougie, by letting the bougie remain a little, it will at last pass, because, say authors, the spasmodic stricture at last gives way. The fact is, that a continued gentle pressure will dilate a common stricture; but there is more than this, often the muscular sheath of the ower part of the urethra, formed by this muscle, the ejaculator, and the muscular fibres which surround the neck of the bladder and membranous part of the urethra, will, for a time, resist the introduction of the bougie, but at last yield. The reason will now be understood why, in introducing the bougie, when there is spasmodic difficulty, we do it when the urine is flowing, or cause the patient to make the effort to pass urine at the time the bougie meets obstruction; for if it be a spasmodic stricture, the action of the bladder will be followed by relaxation of the canal, and the bougie will enter.

OF ACTION IN THE RECTUM.—We shall, perhaps, come to admit that a relaxation takes place in the sphincter ani, if we consider the manner in which the intestinal canal acts through its whole length. One portion of the gut being in action, propels its contents to that which is below, which, relaxing, receives them. Were there not a relaxation in the lower portion, it would oppose itself to the contraction of the upper part.

In the same manner, the superior strength of the muscular fibres, surrounding the extremity of the rectum, is relaxed during the action of the rectum, which allows an easier expulsion of the fæces. It is from this peculiarity in the action of the rectum that I would explain the formation of piles in some instances, and the prolapsus ani. Irritation of the gut gives occasion to an almost imperceptible but constant effort to expel from the rectum; and this effort is attended with a relaxation of the lower part of the gut and of the muscles, which, in action, retain the parts, and counteract the pressure of the abdominal viscera and the occasional action of the abdominal muscles. By continued relaxation of this kind the usual tension is taken off, the parts swell by the influx of blood; the internal membrane is distended with blood, and protruded, forming a species of the hæmorrhoes. The same explanation holds good in violent straining at stool in costive habits; and it should be recollected at the same time, that the contraction made higher in the rectum, may more easily retard the returning venous blood than it can the more active play of the hæmorrhoidal arteries; thereby causing a stagnation of the blood in the extremities of the veins.

2. OF INTUS-SUSCEPTIO AND PROLAPSUS ANI.—In the same manner we have to explain intus-susceptio and prolapsus ani. In the first instance, the gut being irritated at any point, the irritation causes a contraction, while in the superior portion of the canal there is an effort to propel downwards: the consequence is, that the portion contracted by the irritation is forced to slip into the lower portion of the canal. But how is it forced into the lower portion? this is not well explained. It appears evident to me, that this is the effect of the longitudinal muscular fibres; for a portion of the intestine, say six inches, being irritated, contracts; this contraction is not in the diameter of the gut only, but in its length, so that it shall be only two or three inches; the consequence of which is, that the internal coats are gathered together, and being turgid, with blood, they are pressed into the next portion of the gut; by this the contraction is increased and the disease continued. In irritable childhood this often happens.

In prolapsus ani, that laxity of the internal membrane, which is the immediate cause, is frequently produced by irritation; and the internal membrane being first protruded, the effort of expulsion being continued, the irritation increases, and a great part of the gut is inverted. When this accompanies dysenteric affections or diarrhœa, where there has been violent tenesmus and bearing down, it is a most distressing symptom, especially when the counter indications prevent the proper remedies. In cases where there is local irritation (as from numerous ascarides in the rectum of children, or, as sometimes happens, from the stone in the bladder), the temporary or permanent relief from the irritation must be the first object, while astringents are applied to counteract the effect of the loss of pressure.

3. In violent irritation of the rectum, as in long-continued tenesmus of dysentery, the neck of the bladder sympathizes; and what produces relaxation of the gut causes a strangury, or spasmodic constriction in the neck of the bladder, that derangement of which I have spoken above. This we shall readily conceive, when we recollect the strict relation which subsists between the action of the rectum and that of the muscles about the neck of the bladder in their healthy state. The ejection of the contents of both is not allowed at the same time, but requires an alternation of action; which certainly is in a great measure to be accounted for from the connexions of the levator ani; since this muscle, arising from the brim of the pelvis, sends its fibres down upon each side of the neck of the bladder, and embraces it before it reaches the lower portion of the gut, into which it is finally inserted.

4. It may be observed here, that in all such protrusions, whether hernia or prolapsus ani, the most immediate bad consequence is the want of accustomed pressure upon the protruded part, which causes fulness and stagnation of blood. When prolapsus has taken place, the contraction of the sphincter and levator ani tend to increase the evil, by drawing like a ligature upon the protruded gut*.

5. It is by such a view of the parts that we come to have a truer idea of the strict relation which they have to each other; of their sympathies in disease;

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* The consideration of the diseases of these parts is resumed in a subsequent section.

and of what we should expect to feel in a morbid state, upon examining by the anus. Thus, in inflammation of the neck of the bladder, or enlargement of the prostate gland, the pain in making water —the frequent excitement to it—the pain stretching upwards to the kidneys, and extending along the penis to the glans—the pain upon pressure in the epigastrium—the sensation in the rectum of a tumour, or of fæces ready to be expelled (which is occasioned by swelling of the prostate gland);—do in some measure recapitulate to us the anatomy and sympathies among the parts.

6. The student, in dissecting these parts, should naturally be led to inquire concerning the direction of abscesses which so frequently run amongst the cellular substance; of such particularly as may be connected with the urinary organs, the urethra, or neck of the bladder; and of the fistula in ano, or such as run up by the side of the rectum.

7. These abscesses, forming amongst the cellular membranes, become habitual and stationary; being long callous canals, which, by the condensation of the surrounding parts, acquire a smooth internal surface, and from which there is a perpetual discharge of matter.

The leading principle, in the cure of all these complaints, is to discover the cause, and I will very confidently say, that it is either constitutional, or that it proceeds from obstruction in the natural passages.—Remedies to the ulcer are useless.

Of lithotomy.—1. Upon turning our attention to the presentation of the parts in these dissections, we find that the external incision in lithotomy must run in the direction from the arch of the os pubis past the anus, upon the left side of the perineum, and cutting directly through the transversalis muscle, cutting, also, a few fibres of the sphincter, and going deeper, or more penetrating in the middle, so as to reach into the membranous part of the urethra a part of the levator ani is cut.

2. In laying open the groove of the staff, it is very awkward to cut the bulb of the urethra. It nevertheless does sometimes happen, that it is not cut only, but minced with many transverse cuts.

3. The pudic artery is cut by carrying the knife too near the bone: it is often cut by the gorget. When the perineal artery is cut (and indeed it can hardly escape), it does not interrupt the operation.

4. Some or all of these vessels bleed in the operation of lithotomy, and choke up the wound with coagulating blood; so that the operation must be done much more in the dark than we should conceive from the view of the dissected parts. And this should teach us how necessary a strong conception of the anatomy is; not simply such an idea as can enable us to dissect the parts, but a knowledge also of the different parts by feeling, so as to be able to distinguish them during operation.

OF THE SECTION OF THE PELVIS.

The next dissection ought to give a lateral view of the parts contained in the male pelvis. The os pubis may be cut through about an inch from the symphysis, and the os ilium of the same side dislocated from the os sacrum. 1. The first thing to be attended to in this view is, the inflections of the peritoneum. 2. The relation of the bladder and rectum. 3. The exact situation of the bladder. 4. The turn of the urethra under the os pubis, and the place of the prostate gland and vesiculæ seminales. 5. The Bulb and the membranous part of the urethra, and the muscles and ligamentous substance which surround the urethra. 6. Further, the neck of the bladder and prostate gland ought to be pressed down from the arch of the os pubis, and the minute muscles which surround the urethra and prostate gland dissected: viz. a superior arch of transverse fibres lying over the neck of the bladder and the side of the prostate gland, and a posterior and weaker fasciculus mentioned by Santorini and Haller. The compressor prostatæ (of Albinus) or levator prostatæ Santorini, or prostatique superieur (of Winslow).

The levator ani must now be carefully examined, and especially such parts of it as being connected with the bladder have been called levator vesicæ proprior & communis. The muscular coat of the bladder ought also to be now demonstrated.

7. The action and sympathies of these muscles make a very necessary study, as I have hinted above, before we determine on the subject of obstructed urine.

REVIEW OF THE PARTS AS SEEN IN THE SECTION OF THE PELVIS.

1. The BLADDER is, upon the upper and back part, covered with the smooth expansion of the peritoneum: on the lower and fore part, and contiguous to the lower portion of the rectum, it is imbedded in cellular membrane, in which abscess makes rapid progress. The bladder, upon distention, rises before the intestines, keeping close to the pubes, and carrying the peritoneum before it; so as, when much distended, to appear above the os pubis, and to allow of its being punctured, or even to permit the performance of the high operation for the stone without piercing the peritoneum.* As it rises, however, the lower part of the bladder does not proportionally protrude downward, but rather (in the subject) retires from the perineum as the bladder fills.

2. During dissection, the place and degree of the curve of the urethra should be carefully observed, as of the last importance, in all operations in the perineum. It may be observed how strongly the membranous part

of the urethra, or that portion of it which is betwixt the bulb of the urethra and the prostate gland, is supported by the fasciculus of fibres or ligamentum triangulare, and how much dissection it requires to show its membranous nature. In the healthy state of the parts, it seems almost impossible that such rudeness should be employed as to rupture the urethra with the catheter; yet this happens in the diseased state of the parts. The consequence of continued pressure of bougies, however, is that the urethra is at last perforated, because the bougie, being with difficulty directed in the curve of the urethra, makes its way into the interstice filled with cellular membrane, betwixt the neck of the bladder and rectum, and sometimes into the rectum itself! forming a constant draining of urine into the rectum and exciting tenesmus.

3. The PROSTATE GLAND, which is seen surrounding the neck of the bladder, when swelled by any of the causes enumerated below, compresses the canal of the urethra: but a more complete obstruction to the introducing of the catheter arises from its swelling irregularly, or pushing forwards, so as to increase the sudden curve of the urethra, or to shift it aside. In the same manner, tumours, or even abscesses, by distorting the urethra, cause difficulty of passing urine. We see an instance of the distortion of the urethra causing retention, where the bladder is contained in the hernial sac. But in this case, much of the difficulty of passing urine arises from a degree of weakness in the bladder itself, and from its also having lost the co-operating pressure of the abdominal muscles.

4. The section of the pelvis may illustrate another circumstance much dwelt upon by Camper, viz. the point of the catheter being prolonged too far beyond that part of its curve which should be adapted to the curve of the urethra: the

consequence of this is, that when it is fully introduced, the point reaching the back part of the bladder pushes it before it; and the coats of the bladder, clinging round the catheter, prevent the urine from flowing; or, if the instrument be continued in the bladder, there is great risk of the bladder being hurt by the point of the instrument. Cases have occurred of its making way into the rectum from the bladder.

5. It may be observed, too, how much of the bladder is, in sounding, under the curve of the staff; how a stone, gravitating into the lower part, may be over-reached by the staff or catheter, and no grating be felt but by forcing the convexity of the staff downwards in sounding. The stone falling into this more depending part of the bladder, in the prevailing posture of the body, may form a lodgment there. This would undoubtedly more frequently happen, did the bladder always retain its natural pliancy and thinness of its coats; but the consequence of the presence and irritation of a stone in the bladder is a thickening and contraction of the coats, which tends to prevent the formation of cysts.

6. In puncturing the bladder from the rectum, we see how the prostate gland being enlarged may be mistaken for the bladder, and the trocar plunged into its solid substance.

In puncturing by the perineum also, we must recollect, that if the disease be in the prostate gland, it is enlarged, so that there is a great probability that the trocar shall be passed into the substance of the gland, without penetrating into the bladder.

I have seen an instance of the trocar in this operation having passed through the urethra: upon withdrawing the stilet no urine flowed from the canula, because it had transfixed the urethra (which had been dilated behind the obstruction); but upon withdrawing the canula a little, and freeing it from the opposite side of the urethra, the urine flowed in full stream. The canula upon this was further introduced again; but, instead of taking its former direction, it slipped along the urethra, and found its way into the bladder by the natural passage. This appeared upon the dissection.

In the subject we see how the bowels press down into the pelvis in the erect posture of the human body: but we may observe also, how the viscera of the pelvis, being more firmly connected by cellular membrane and constricting muscles, support the weight of the abdominal viscera; that, by the combined power of the perineal muscles, levator ani, sphincter, and coccygeus muscles (the antagonists of the abdominal muscles and diaphragm), the prolapsus of the parts is prevented; yet we can conceive in the female pelvis a hernia of some of the intestines, betwixt the vagina and the rectum, forming a tumour pushing down from the vagina; or here sometimes a hernia may insinuate itself betwixt the bladder and os pubis, getting access to the thyroid hole; nay, there are even instances of hernia protruding upon the hip from the sacro-ischiatic hole.

Still another very useful view of the viscera of the pelvis may be had, by taking away the os sacrum and dissecting the parts, separating the rectum and bladder, but preserving all the connexion of parts, and the muscles in their natural situation. The arteries of the pelvis will of course form part of the demonstration. (See Appendix.)

FURTHER DISSECTIONS OF THE URETHRA AND BLADDER.

The bladder and penis being taken from the pelvis, and freed from all the muscles, we have to examine the spongy bodies of the penis, the prostate gland, the vesiculæ seminales, and the urethra itself.

In the examination of the urethra we ought to be very particular. 1. When the urethra is opened, it has sometimes the appearance of having muscular fibres in its inner coat, but this is a deception, owing to the slight rugose state of that membrane when the penis has shrunk. 2. The next thing to be looked to is the LACUNÆ. They are very numerous on the anterior half of the canal. They are largest, too, on the side of the urethra next the body of the penis, which makes us, during the introduction of a bougie, bear the point of it, for the most part, against the lower side of the urethra. 3. The seat of gonorrhea is in the fore part of the urethra. Mr. Hunter said within a little way of its extremity. This is always the situation of the inflammation in the first instance, I presume, from the symptoms, and from Mr. Hunter's dissections. 4. I have dissected the parts in what I conceived to be a later stage of the disease, when I found that, within two inches of the termination forward, the urethra was loaded with blood, but I saw, also, that the same inflammation was for the extent of two inches at the bulb. In stricture of the middle of the canal, I have found the urethra inflamed at the anterior extremity, and at the bulb in the same manner. 5. The following are very frequent circumstances in practice. A gentleman has a gonorrhea, he can force matter from the fore part of the canal until it is quite clear, and nothing flows, but, by pressing the perineum, a quantity of matter is to be forced up greater than at first. Again, as I pass the small ball probe into the urethra, near the extremity, there is pain, and matter can be brought out, in introducing the ball further into the canal there is no pain nor matter, but on passing it into that part which is near the bulb, there is great soreness, and matter is brought out. I have little doubt then that the inflammation either passes by sympathy, from its seat near the extremity, to the part of the urethra which is at the bulb, or that the inflammation, making its progress along the canal, subsides in the greater extent, but becomes fixed near the bulb, owing to the greater natural irritability of that part. 6. A discharge which resists the use of injections and is yet in the ſore part of the urethra, will be found to proceed from the large lacunæ. Being in a state of suppuration, the continued inflammation of the lacuna produces a hardening and swelling of the surrounding cellular membrane, so that it appears like a gland, both to the feeling during life and on dissection. 7. The PROSTATÆ INFERIORES, or Cowper's glands (see his *Myotomia*, tab. xix.) I am inclined to think they are an effect of inflammation. I have often found them. I have found a gland on one side and not on another, but in general they are not to be found.

OF STRICTURE.—Strictures I have ascertained by dissection to be of several kinds. 1. The first is the simplest and most common and such as is represented in Mr. Hunter's plate—a portion of the canal, not greater than the sixth or seventh part of an inch, has lost its elasticity and remains undilatable; on inspecting it narrowly, the disorder is seen not to be in the inner membrane of the urethra only, but in the surrounding membrane and sometimes the spongy body is drawn into a less compass, and is become dense and white. 2. The surface of a stricture is in general smooth, but I have found it curiously reticulated, an effect I have supposed of ulceration in the part, yet when abscess forms by ulceration, it is behind the stricture. 3. I have seen a stricture where the patient died after the application of the caustic. One half of the stricture had been destroyed, and, in place of the firm dense sides of the urethra, soft fleecy shreds hung from the surface. 4. The second kind of stricture is that in which a considerable portion of the canal has suffered by deposition of additional matter, which now deprives this part of its natural elasticity, and it remains irregularly contracted. 5. A third kind of stricture is where the urethra is contracted, and the spongy substance wasted. On dissection, I have found a stricture of this kind two inches in length. 6. The spasmodic stricture is quite an improper term. The symptoms which have given rise to this term belong to another disease. When the death has been owing to the sudden increase of the stricture, or the interruption of the flow of urine by the falling forward of a small calculus against the stricture, I have found that the whole tract of the urethra and bladder was greatly inflamed, and the inside covered with shreds of coagulable lymph ; the coats of the bladder loaded with blood, the ureters and kidney distended and inflamed. 7. There is found a little serous effusion on the brain of those who die of obstructed urine. This is the effect of the continued irritation and fever, and is not of the nature of a translation of the excretion.

8. Fistula in perineo may become the subject of anatomical investigation, for, in the first violence of the disease, it sometimes destroys the patient, and, by tedious suffering, it often wears out the strength and constitution. Mr. Hunter held an opinion, that sometimes the mouth of the lacuna contracted, and that the secretion being retained, as in fistula lacrymalis, an abscess formed : on the con-

trary, I believe that, in all cases of fistula in perineo from disease, the origin is from the stricture of the urethra. On dissection, the circumstances to be attended to are the place of the urethra, which has ulcerated and its relation to the stricture, the state of the stricture in the urethra, the extent of the fistulous openings, and state of the cellular membrane of the perineum and about the neck of the bladder; the state of inflammation of the urethra, bladder, and kidnies—with a view of contrasting the appearances and symptoms, and deciding on the manner of operating in similar circumstances.

I have not seen any thing like warts or tumours of the urethra.

9. A very valuable part of Mr. Hunter's book is his account of the diseases of the prostate gland: he describes the manner in which the gland swells in its greater mass which is below the urethra, so as to raise the canal. He ascertained that sometimes one side only is enlarged, so as to distort the canal, and particularly that there was a part of the gland seated behind, which swelled up even when the gland was not generally diseased, so that, projecting into the bladder like a valve, it obstructed the urine. The gland will, therefore, be examined with a view to understand the effects of its disease upon the canal of the urethra which passes through it, and the manner of insinuating the catheter past an obstruction of this kind.

10. In enlargements of this gland the constricting fibres upon the mouth of the bladder have a strange effect in moulding it as it were, for while it enlarges the fibres protrude it backwards into the cavity of the bladder.

11. Dr. Baillie has found this gland with scrophulous pus in it.

12. The enlargement of this gland may sometimes not improperly be called a varicose enlargement; be-

cause the enlargement is not so much of its substance as of the surrounding parts and circle of veins, which are in situation and diseases somewhat analogous to the hæmorrhoidal vessels. I have seen in the neck of the female bladder as great an enlargement as in that of the male; and in many cases, in dissecting diseased parts, to give a clear and distinct view, the tumour gradually vanishes, and, before we are aware, no mark of disease remains. But of this there is no danger in the most frequent kind of disease, the most incurable and distressing malady, the schirrous enlargement in old men. Too frequently, in the last stage of life, disease, and the debility of old age, falls upon the urinary passages, causing an irritability in the bladder and swelling of the prostate gland, and terminating life with excruciating agony

13. Even when no mark of disease is apparent, yet, upon cutting into the gland, small chocolate-coloured stones, like seeds, are found filling up its ducts, or in little sacs. I have seen this gland stuffed with them like the gizzard of a fowl.

OF THE DESCENT OF THE TESTICLE; OF THE MANNER OF DISSECTING; AND OF THE DISEASES ILLUSTRATED BY THIS PIECE OF ANATOMY.

The descent of the testicle in the fœtus is, in a physiological light, extremely curious, and almost inexplicable as a piece of anatomy. It is with some difficulty comprehended at first, but worthy of our utmost attention, as illustrating many important diseases; hernia, hydrocele, and all diseases of the testicle, chord, and abdominal ring.—*See our Anatomy of the Human Body.*

When a fœtus is procured in which the testicles have not descended, it may be dissected with a view to the following circumstances :—

1. The testicle will be found in its progress downward from its original situation on the psoas muscle. 2. The petitoneum on the inside of the ring will appear as if perforated ; into this a small probe being pushed, it will pass obliquely into the groin, and being cut upon there, it will be found to have entered into a process of the peritoneum, resembling the finger of a glove. 3. The vessels will be observed running to the testicle, and the vas deferens descending. 4. On the side of the pelvis under the peritoneum, and stretching from the testicle towards the ring, the gubernaculum testis will be discovered. 5. If the testicle shall have descended, yet the process of the peritoneum, which projects before it into the groin, will still be open, and, by passing down the probe into this process, it will come in contact with the testicle as it hung originally on the loins. If, on the other hand, the scrotum be now opened, the coats of the testicle will appear as in the adult state. After taking off the dartos, the vaginal coat will be seen, and, on opening this, it will be found to be the same sheath or process of the peritoneum, into which the probe had been introduced, and, on fully exposing the testicle, the tunica albuginea will be understood to be the membrane covering the testicle, as it originally hung on the psoas muscle.

THE COATS OF THE TESTICLE OF THE ADULT, AND SOME OF ITS DISEASES ILLUSTRATED FROM THE ANATOMY OF THE TESTICLE OF THE FOETUS.

Cause of the descent of the testicle.—It is utterly impossible to account for the descent of the testicle by any mechanical action, by the pressure of the abdominal muscles, by the peristaltic motion of the intestines, by the generation of wind in them, or by gravitation :—for the fœtus lies in the womb with the head downwards, the abdominal muscles are quiescent, and the probability of occasional inflation in the intestines of the fœtus is very small. Besides, any general pressure would, at all events, more probably act upon some of the loose viscera, and produce rather a hernia than the regular descent of the testicle.

The action of the gubernaculum is the more natural explanation. It guides the testicle into its destined lodgment, and probably solicits it by a gentle action. Yet this action is unlike the action of other muscles, being unremitting whilst the testicle is within the belly; and when the testicle is arrived without the groin, a relaxation must take place, allowing the testicle to descend into the scrotum. It is worthy of remark, that neither the spermatic vessels nor the vas deferens appear as if elongated or stretched, but retain their tortuous waving figure. Under the title of GUBERNACULUM TESTIS, the fibres of the future cremaster muscle are included; and by many this muscle is thought to have the chief action in bringing down the testicle. The fibres of this muscle are with difficuly demonstrated in the human fœtus; but, from comparative anatomy, it is found that it is reflected from its origin from the transversalis abdominis upwards, following the gubernaculum. In this situation of the parts in the fœtus, the cremaster muscle must lie behind the peritoneum; but in the adult, as that side of the peritoneum which is contiguous to the psoas muscle becomes (in the scrotum) the outer surface of the peritoneum which covers the chord, the cremaster becomes an outer layer of fibres embracing the chord. The exit of the testicle through the abdominal ring is certainly facilitated by the gubernaculum as a precursor. It altogether forms a body of a wedge shape or pyramidal form (its base being upon the testicle) which must gradually dilate and fill up the abdominal ring, and make way for the testicle. When the testicle is as yet far up upon the loins, the gubernaculum is slender; by its contraction it becomes thicker; and before the testicle has arrived at the outlet, it is little larger than the contracted and thickened gubernaculum which has preceded it.

SITUATION OF THE TESTICLE IN ITS FULL DESCENT.—As the testicle descends, the process of the peritoneum accompanying it changes by insensible degrees. Though we see in a child upon one side the testicle lying behind the peritoneum like the other viscera of the abdomen, yet, upon the other side, if the testicle have fully descended, we shall have some difficulty (from the additional layers of cellular membrane it has acquired) in dissecting the vessels from the peritoneum, to shew that the vessels run down behind the sac to supply the testicle. Shortly after the descent, the prolonged sac of the peritoneum coalesces with and surrounds the spermatic chord, now composed of the spermatic vessels, the vas deferens, and the muscular fibres. These form one mesh; so that no passage remains pervious from the cavity of the abdomen down betwixt the tunica vaginalis and the unica albuginea. Mr. Hunter was of opinion, that in those cases where the testicles remain in the belly, the testicles are diminutive, and more imperfect than those which descend into the scrotum. There is undoubtedly something defective in the testicle when it does not descend, and a tendency in it to form adhesion to the intestines indicates disease or imperfection.

OF CONGENITAL HERNIA.—How widely different the causes of the descent of the testicle are from those of a rupture, appears from the rarity of the occurrence of the congenital hernia, or the passing down of a portion of the intestine along with the testicle.

This is very remarkable, when we consider that a turn of the intestine is not larger than the testicle to which it lies contiguous, and that the testicle remains long in the very ring dilating it; yet by the peculiar mechanism and interlacing of the fibres of the ring, the intestine is not allowed to follow. Indeed, I am of the opinion of the celebrated Wrisberg, that the congenital hernia does rarely happen but by a previous adhesion of some of the intestines to the body of the testicle, by which it is drawn down along with it. Wrisberg found the ring, in several instances, so wide, and the parts so lax, as easily to allow the descent of a portion of the gut or omentum; yet in these cases there was no hernia. Again, he found in other young subjects, where the testicle still remained in the belly, that it had contracted adhesions with the omentum. And, lastly, he found in a case of old congenital hernia (upon opening the belly), that a portion of the omentum seemed to be attached to the ring; but, upon further dissection, he found it continued down through the ring, and adhering to the tunica albuginea of the testicle. In other cases, he found the testicle so connected with intestinum cæcum, that in pulling the one either way the other followed; and, what he conceives to be a convincing proof, he found in one side of a subject a fasciculus of fibres attached to the testicle, and inclosed in a duplicature of the peritoneum; while, on the other side, though the ring was so wide as to allow the finger to slip in, there was no hernia. From these facts, he conjectures that the congenital hernia is, for the most part, formed in consequence of adhesions betwixt the testicle and viscera; and that the intestines, or omentum, are, in consequence, drawn down along with the testicle. It is a curious circumstance, if fully proved, that the testicle not only most unaccountably comes down into the scrotum, but that its tendency thither is so great as to pull down the intestine, and elongate the mesentery also.

It would be an idle repetition to point out the method of dissecting and investigating the congenital hernia, since the circumstances of its anatomy, and its character and peculiarities, have been already detailed. The appearance of the more common rupture may perhaps be more opportunely illustrated here.

OF INGUINAL HERNIA.—Although the abdominal ring be preternaturally wide, if the testicle shall have descended naturally, and the peritoneal sheath be closed, hernia congenita is for ever prevented; but if, upon any unusual exertion, a portion of the intestine shall be forced through the ring, the old sheath is not opened, but a new sac of the peritoneum is forced down; and though it take the same course with the testicle, it still, in all its stages, remains detached, and in a distinct process of the prolonged peritoneum.

In an old case of hernia, and where the patient's death has not been occasioned by the rupture, the ring is wide, the intestine loose in its sac, and the testicle lax, hanging far down, and often much wasted. Upon laying open the integuments, the peritoneal sac of the hernia comes into view; and when the chord and testicle are extricated in all their length, the preternatural sac has no marked limits, but seems gradually to coalesce with the chord, being enveloped in loose cellular membrane and vessels. Upon dissecting up towards the abdomen, we find no ring, but the sac of the hernia gradually blended with the tendon of the external oblique muscle; which, stretching over the neck of the sac, is so closely mingled with it, that it is only distinguishable from it by the splendor of its encircling fibres. To demonstrate further this preternatural connexion, we lay open the belly, and examine the state of the viscera and the portion of the gut protruded; we dissect the peritoneum carefully on the inside, from the muscles and ring, showing how it forms a sac inclosing the hernia. We take notice of the oblique or direct manner in which the sac passes through the ring. We are careful to observe the natural appearance of the peritoneum, where it is remote from the ring, and on the contrary how it is thickened and united with the cellular membrane in the ring. Then we show the spermatic chord going down quite on the outside and behind this sac, and the obliquity of its course from the abdomen; we lay open the vaginal coat of the testicle, showing that the testicle lies distinct in its appropriated coats: and lastly, show the hernial sac distinct from the spermatic chord or coats of the testicle; or ring of the tendon of the external oblique; and, as we raise the pillars of the ring from the neck of the sac, we are careful to observe how the fibres are dispered and expanded over the neck of the sac.

APPEARANCES OF STRANGULATED HERNIA.—In a strangulated hernia, where it has been the immediate cause of death, though the essential circumstances of the anatomy remain the same, the occasional occurrences are infinitely varied. Upon making an incision to lay bare the sac, it is found tense and firm, crowded with vessels, and thickened towards the ring; but over the proper sac we notice the several lamina of the cellular membrane; the marks of inflamation are great, and chiefly owing to the efforts to reduce the hernia.

Upon opening the belly, the intestines are found inflamed and distended; pus and coagulable lymph is on the surface, by which they are often slightly glued together. If the hernia has been large, the mesentery is elongated by the pulling of the intestines, and the viscera in much disorder, even the stomach having descended from its place; so that sometimes in very large hernia the abdomen is left almost empty of the floating viscera. In a case where the intestines have been reduced either by the operation or taxis, the reduced portions are found lying within the ring adhering; often sphacelated. Upon laying open the sac of the hernia if of old standing, it is found to consist of many layers, smooth as the abdominal peritoneum within, including most commonly the omentum, or a portion of the ilion in the sac. If the person has died of unreduced strangulated hernia, there is bloody serum in it. The intestine is dark coloured, and has on it black or livid spots; and on the surface, sometimes, coagulable lymph. The coagulable lymph marks this circumstance, that inflammation of the protruded portion of the gut preceded the strangulation. When a gut is strangulated, inflammation is over, and where it takes place suddenly there is no coagulable lymph. If the omentum have fallen down, it will have altered much of its nature, become firm and condensed; composed of hard pellicles of fat irregularly connected by membranes; with frequent strings of adhesion, tortuous dilated veins, and general inflammation. If the strangulation of the gut have advanced far, then it is dark and mortified, with foul serum in the sac. Adhesions are frequent betwixt the doublings of the gut, more rarely between the gut and sac, on the outside of the ring. It would appear to me that the irregularity of the functions of the intestinal canal, the inflation or congestion of the protruded portion of gut, is the more frequent cause of strangulation, and of the worst symptoms, in old hernia; and that the inflammation and constriction of the neck of the sac is secondary merely. Sure I am, that the intestine is seldom reduced by the mechanical exertion; but merely the flatus in the intestine is forced into the intestines within the belly, and then the portion which had descended is drawn in by the action of the intestinal canal: and, again, it would appear, that frequently in attempting the reduction, the mouth of the sac is pushed aside from the ring, and the reduction prevented.

When the strangulated portion of the gut gangrenes, the fascia, cellular membrane, and glands of the groin, form one confused fœtid mass, and air is generated in the cellular membrane; all that can be done, I believe, in operating in the living body, is to lay the gut freely open, and leave it to nature: the upper part of the canal being opened, the load is evacuated by this artificial anus. The patient has sometimes survived such an operation; continuing to discharge the fæces by the groin. I have dissected the parts where the patient has lived some time with an anus at the groin. Both ends of the intestine are found adhering to the peritoneum, and adhering and fixed to the passage of the abdominal tendons; and, what is more important to observe, adhering to each other. I have conceived, that by an operation the course of the fæces may be directed into the old channel again, but this is no place for the discussion. It is a curious resource of nature, by which the fæces spontaneously resume their natural course to the rectum, although a complete turn of the gut has been cut off. This is accomplished by the sides of the intestines, strictly included in the ring, or under the femoral ligament, forming an adhesion and communication with each other; which is completed by the closing of the ulcer in the groin. This takes place more frequently in the small femoral hernia of women.

I have given here a few hints, which I hope will be sufficient to enable the surgeon to take advantage of his opportunity of private dissection. But for the full elucidation of this subject, he must turn to Mr. Cooper's work on hernia, the highest example we have of pathological research.

Of hydrocele.—As in the last species of hernia the intestines take a new route, and are preceded by a distinct sac of the peritoneum; so, in hydrocele, the tunica vaginalis testis being distended with fluid, the original sheath is not again opened, but that part which envelopes the chord (now degenerated into loose irregular cellular membrane) remains entire, while the distended sac swells on all sides, but chiefly upwards, and before the spermatic vessels, conically. So that, upon laying open the sac in the operation for the radical cure by incision, the testicle is seen covered only by its proper tunica albuginea, unless when, by frequent tapping, a partial inflammation has been communicated to the testicle; in which case, it very commonly adheres to the fore part of the tunica vaginalis which had been punctured with the trocar. In hydrocele the water is green or yellowish, the tunica vaginalis is commonly thickened, and the testicle sometimes small and compressed, but sometimes, and indeed more frequently, larger and soft. To demonstrate the anatomy of an advanced hydrocele, we inject the spermatic vessels, follow the chord down behind the sac formed by the dilated vaginal coat, fill the sac, by a small puncture, with spirits, and harden the whole in spirits for a few days; then open the vaginal coat, to show the situation of the testicle; the preparation may be preserved in spirits. I have in two cases examined the coats of the testicle after the use of the injection for hydroeele: in one of the instances, the two coats had adhered by the intervention of a fleecy cellular substance; the other had partially adhered, and where it did not adhere, the water was collecting.

The diseases of the spermatic chord show us how completely it is changed in its nature from that of the peritoneum; for its cellular structure sometimes becomes the seat of dropsical swelling, forming a species of hydrocele: sometimes it appears like a collection of hydatids, yet neither communicating with the vaginal coat of the testicle nor with the cavity of the abdomen: sometimes the hydrocele consists of only one or two vesicles; and, when the lower portion of the chord is pressed, the swelling subsides, and retires to the cells in the chord within the abdomen.

Loose cartilages are sometimes found in the tunica vaginalis, a frequent occurrence is that of small soft bodies attached to the epididymis.

FURTHER DISSECTION OF THE TESTICLE.

To prepare the testicle for the demonstration of its structure, the chord must be kept very long, the spermatic artery and vein injected with different coloured wax injection. Then the mercurial tube must be fixed into the vas deferens, and the seminal vessels injected. To demonstrate the lymphatic vessels, we may blow into the substance of the testicle by puncturing the tunica albuginea, or we may force mercury into it, and by forcibly squeezing the testicle, the lymphatic vessels will be filled by the air or mercury. Or if the vessels and ducts be already known to the student, and he wish only for such demonstration as may enable him to understand the physiological opinions given during the controversy on this subject in the Thesis of Dr. Monro, De Valvulis Lymphaticis, and Medical Commentary of Dr. Hunter; let him only inject the spermatic artery with mercury, and observe the progress of the injection. First, the branches of the arteries filling, the mercury will be seen returning by the veins; then the lymphatics will be suddenly distended; and lastly, the seminal vessels will be filled. I have no doubt that the mercury gets into the two last classes of vessels by bursting into the cellular membrane, and, at the same time, lacerating the branches, and entering the sides of these vessels. What confirms me in this opinion is, that I have filled the seminal vessels and epididymis, by thrusting a pipe into the substance of the testicle.

By such experiments, the fallacy of all proof of function from the mere circumstance of dissection, is made apparent; for, in the filling the lymphatics by extravasation, there is no more proof of their rising from the cellular texture, than of the arteries, veins, or seminal vessels doing so.

Having considered the original situation of the testicle; the source of its arteries, veins, and nerves; the progress of its descent; and hence seen the reason of its extensive sympathies; being, in fact, in all respects, as a viscus of the abdomen. Having dissected the vessels of the chord, opened the coats of the body of the testicle, and floated the delicate tubuli testis in water; having traced these tubuli to the rete testis, where they are united on the dorsum; followed the rete testis, and seen the manner in which the vascular cones, or vasa efferentia, were derived from it; then traced the vascular cones into the epididymis, observed the manner in which this wonderfully convoluted vessel lay on the testicle, so as to recognize the parts in the living body, the student is well prepared to consider the diseases of the testicle.

1. VARICOCELE. The enlargement of the veins of the spermatic chord is a frequent disease, and yet we are apt to pass it over in dissection, owing to the collapsed state of the vessels. There is no disease more frequently met with in private practice. 2. Nor do I conceive this the place to speak of the inflammation of the testicle, nor of abscess in the body of the testicle. 3. The scrophulous testicle is described as if the substance of it was degenerated into a white or yellowish, curdy substance, mixed with pus. 4. I have found it enlarged, hard, and elastic, when covered with its coats; soft and pulpy, and vascular, when the albuginea was opened.

5. But the most frequent appearance is scirrhus. It is enlarged, irregularly hard. When cut into, the tumour is found to be intersected with membranes,

which is the internal character of true scirrhus, and in the center there are sometimes cells found.

6. The cancer of the testicle, resulting from the ulceration of this scirrhous enlargement, having its chief character in the living body, we having nothing to do with here. 7. The testicle has been found both cartilaginous and boney. 8. The vaginal coat of the testicle I have seen so greatly thickened as to be mistaken for a scirrhus of the body of the testicle, for which the whole was amputated. 9. The testicle wastes, and almost totally disappears. 10. It sometimes remains in the abdomen, or slowly descends about the time of puberty, which is supposed by Mr. Hunter, with every appearance of truth, to proceed from some imperfection of the testicle.

OF THE INVESTIGATION OF DISEASE IN THE PELVIS, AND OF THE MORBID STATE OF THE PARTS.

In their diseased state, the parts in the pelvis should not be cut out hastily, or before attention be paid to such points as can alone be illustrated by an examination of the parts in situ. After the great operations, the spreading of inflammation to the bowels, the stage to which the inflammation has proceeded, the quantity of matter, and the course of sinuses near the wound should be observed:—then the parts being carefully washed, and the vessels perhaps injected (if the state of the subject will allow it, and if they be of consequence in the dissection, as after lithotomy), a freer investigation may be allowed.

For example, in a case of lithotomy, we have to observe the state of the intestines. If the patient has died soon after the operation, the degree of inflammation among the intestines, and their distention; if the patient has lingered, and died debilitated, the inflammation will have subsided, and there will be adhesions amongst the intestines, inflation, and scybalæ; the lower portion of the colon, at least, will be distorted and inflated, and will be found to have preternatural adhesions. We have to observe the direction of the incision; the state of the wound; the sinuses, that too often stretch up from it by the side of the rectum, and the effects of which will be seen upon the peritoneum, by folding back the rectum from the sacrum.

In dissection, after the operation of puncturing the bladder, or after a tedious case perhaps of retention of urine where the catheter has been used, the instruments should be allowed to remain: then the bladder being opened from above, we can observe their true place, see them projecting into its cavity, judge of their effects, and of the inflammation in consequence, and of their pressure and effects on the neighbouring parts or opposite side of the bladder. In taking out the parts, the penis should be first separated from the pubes (which, by the by, may he done without leaving any apparent deficiency, by leaving the skin and glans), the crura cut from the bone, and the whole forced down under the arch of the os pubis: then, proceeding to the inside, cut all freely out, by carrying the knife close to the bones of the pelvis; by which all the parts are retained for further investigation in their natural connexions.

Of the bladder.—1. Where there has been obstruction of the urethra, the bladder is always greatly changed: if the obstruction has been sudden, the coats are little thickened, but the inflammation is great, the vessels are numerous, and there are many spots red with extravasation. 2. If it has been sudden and absolute, the bladder suffers astonishing dilatation; it does not burst; it is said to burst, but

I have found one or two small holes in the fundus, with irregular black edges, and the urine escapes among the viscera and inflames them. 3. If the obstruction has been of long standing, and gradually increasing, then the bladder is small, and the walls greatly thickened. 4. When stone is in the bladder, the coats are very often thickened, in consequence of the incessant irritation, and, if not inflamed yet, its inner surface is covered with slime and mucus. 5. The inner surface of the bladder is found ulcerated, and abraded. 6 In those who die violent deaths, the bladder is found firmly contracted. 7. It is found in old people contracted considerably, and equally incapable of much dilatation or further contraction. 8. The inner surface of the bladder is, in some instances, diseased with fungous excrescences; they are soft, spongy, and full of blood; and not uncommonly such tumours have deposited on them a calcareous matter, which, during the life of the patient, is with difficulty distinguished from a stone. 9. In some rare cases, stones have been formed in those tumours. There is an explanation of this. I believe that calculous matter will adhere to a diseased surface, though it will not concrete upon the smooth and secreting surface of the internal coat of the bladder. Thus, after lithotomy, I have found the lips of the incision into the bladder prominent, and covered with a calculous crust, but none where the secreted mucus was poured out. 10. It is a very rare occurrence to find the stone lying betwixt some of the stronger fasciculi of fibres. 11. I have repeatedly found the rectum of young children terminating in the bladder. 12. A portion of intestine will sometimes attach itself to the bladder, and in time form a fistulous communication. We have to expect some curious and interesting cases of this kind from Dr. Cheston. of

Gloucester, who is about to give us the result of his experience in morbid dissection.

The VESICULÆ SEMINALES seem to be seldom the seat of disease, though, from their situation behind the prostate gland, they must frequently be involved in the diseased state of the rectum and bladder. Something of their affections has been already mentioned. Dr. Baillie has found them with scrophulous matter in them. They are said to have stones in them, and have suffered by scirrhus.

Though not a viscus of the pelvis, yet, from its strict relation to the last subject, I am induced to say a few words on the morbid anatomy of the kidney.

OF THE KIDNEY.—The varieties in the form and distribution of the emulgent arteries and veins, and in the ureters and pelvis, and whole of the gland, are so frequent, that they can scarcely be considered as curiosities.

1. Coagulated blood, or concreted mucus, frequently forms the nucleus of calculi in this gland and in the bladder. The natural mucous secretion, which continually exudes from the urinary passages, allowing no deposition from the urine to take hold upon them, prevents the formation of calculi; but when a particle of dead matter lodges, concretion immediately forms around it. Urinary calculi may be the symptom of a more universal disease in the assimulating organs, or they may be only casually produced in the bladder by an accidental nucleus of this kind. Small grains of sand are sometimes found, even in the tubular part of the kidney. But commonly they are found lying in the pelvis or calices, and very often they fill the whole pelvis, and ramify into the calices or infundibuli. Then the cavities are enlarged, and the substance of the kidney distended. Sometimes the natural appearance of the substance of the kidney is lost.

2. Suppuration following inflammation of the

kidney, will form at one time an immense deposit of matter, converting its substance into a sac of pus; at another, only partial abscesses are formed. Such collections have sometimes been evacuated by the ureters, causing in their course, before they got to the bladder, dangerous retention of urine; or it may happen that, by communicating with the colon, the matter may be evacuated by stool. It may spread amongst the surrounding cellular substance, or it may even point outwardly to the loins. Such diseased action in the kidney has gone so far, that the whole substance has been destroyed, and its seat has been only marked by a more condensed indurated cellular substance.

3. The kidney sometimes acquires an enormous size; or it becomes soft; or degenerates into an assemblage of hydatids; or perhaps a steatomatous mass.

4. Scrophulous tubercles have been seen in the kidney. 5. Dr. Baillie has found it scirrhous.

We may be at once sensible, why, upon inspiration and expiration, or in going to stool, or in efforts to make urine, the pain of inflammation in the kidney becomes more violent, when we observe its situation upon the muscles of the loins and upon the diaphragm, and how it must be affected by the play of the latter muscle. We may understand, likewise, how, in inflammation or enlargement of the kidney, a stiffness and numbness is produced in the thigh, loins, and testicle, in consequence of the contiguity of the anterior twigs of the lumbar nerves; which, running downwards, play upon the groin, fore part of the thigh, and testicle. 6. In retention of urine from the obstruction of the URETERS by stones, hydatids, or clots of blood, the ureters are sometimes so much dilated as to resemble a small gut; and they become, at the same time, tortuous, or are irregularly distended; and, in their partial dilatations, their internal coat is stretched across like a valve. Their coats, too, in all such cases, become thickened. Where there is no obstinate resistance, even the pelvis and ducts of the kidney become enlarged like a second bladder, and greatly inflamed. 7. It is in this case only, in which I have observed inflammation of the capsuli of the kidney. 8. I have carefully examined the kidney in diabetes, but observed only that it was larger and softer, and the vessels proportionally enlarged and soft; that appearance which indicated increased activity, but not inflammation.

Of the rectum.—The rectum being a very glandular part, largely supplied with veins, and exposed to a variety of exciting causes, is very subject to disease; and peculiarly to scirrhous thickening and contractions of its cavity. The contraction is in general about two inches from the anus. When such derangement proceeds to cancerous ulceration, it makes an ugly mass of dissection. 2. In the last stage of such a case, it will be found that the bladder is drawn into disease; that the the surrounding cellular substance is hard and scirrhous, and that abscesses run through it, forming communications with the gut above the stricture. 3. It is subject to have soft spongy tumours growing in the inner surface. 4. The verge of the anus is the seat of piles. These are tumors of enlarged veins, with much coagulable lymph deposited around the veins. 5. The inner surface and margin of the gut is subject to descent and consequent ulceration. 6. Spongy excrescences are frequent about the verge of the anus. They are, I believe, rarely cancerous.

END OF VOL. I.

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